AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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VOLUME 21. NEW YORK, THURSDAY, APRIL 14, 1898. NUMBER 15.

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Screw Lathe Tools and Work.

BY A. H. CLEAVES.

The following screw-lathe tools in use by the Chicago Manufacturing & Optical Company are found, after a good test, to be about as satisfactory (where they can be used) as anything that has been tried there. This refers more especially to the device shown in Figs. 1 to 4. These tools are made to retain their form when ground and are milled or planed any number and variety of patterns. They are very rigid —far more so than any tool made in the circular form and fastened to the side of a bar held in the tool-post. This kind of a tool might be properly named the hog-bite, and while not so favorable to diameter accuracy, perhaps, as the box tool, is more so as to length and shoulder measurements. Still it is all right for any kind of general work.

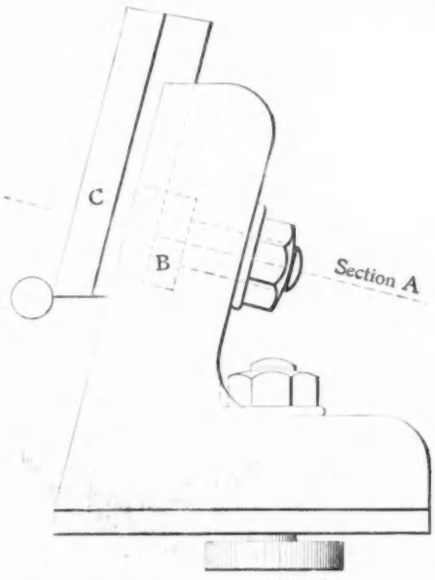

Fig. 1

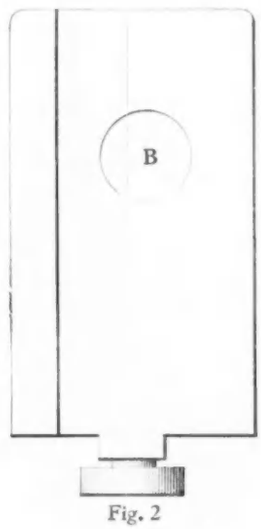

Fig. 2

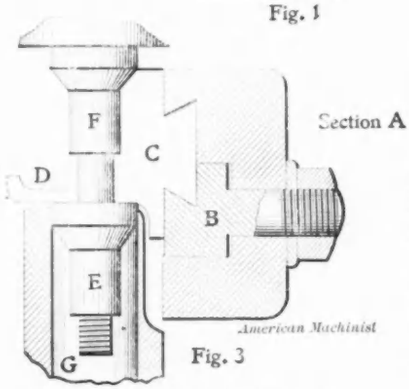

Fig. 3

SOME SCREW MAKING TOOLS.

The holder illustrated in these sketches was fitted to a Pratt & Whitney No. 1 screw-lathe, the back-tool holder being shown in Figs. 1, 2, 3, and the front one in Fig. 4. Fig. 3 is a section at *A*, Fig. 1, and a sample of the work. In Fig. 3, *B*, the tool binding clamp is shown, *C* being a section of shouldered screw-making tool. Dotted lines at *D* show cutting-off tool position after *E* has been threaded and moved away from chuck, and the cut with *C* has been made on *F*.

The hollow rest for supporting the work for the heavy cut is held in the turret, and may have a pump center or rod with spring behind it for pushing *E* out of the hole if desired.

Fig. 4 shows a cutting off tool in the front holder, and both holders take the place of the regular tool-posts in use.

Fig. 5 shows a sample of small manufacturing, being an emery-wheel shaft *H* in a machine bearing *I*. A set screw seat is seen at *J*, where the pulley *K* is fastened. The collar *L* is tight on *H*, and is made in the screw lathe with the tool shown in Fig. 6 after being faced off at *M*. The pulley *K* is finished with a similar tool. These two pieces reach over the casting *I* at *N N*, and keep the emery dust from the bearing.

The tool shown in Fig. 6 is made in the milling machine and ground as required at *O* without losing its form. The shank *P* fits hole in turret of screw-lathe. This part of the reamer *Q* are all one solid piece. For myself I prefer a reamer fluted the whole length of reaming diameter, with about a thirty-second land back of the cutting edge stoned off by hand instead of being ground concave. If used as a reamer rather than a drill it will last long enough for this life.

The reamer can be ground to diameter

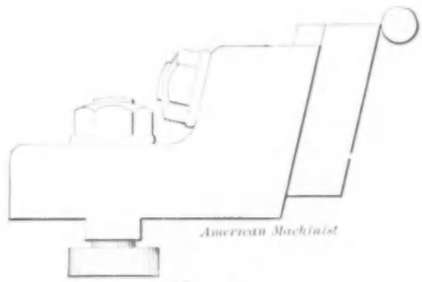

Fig. 4

CUTTING-OFF TOOL.

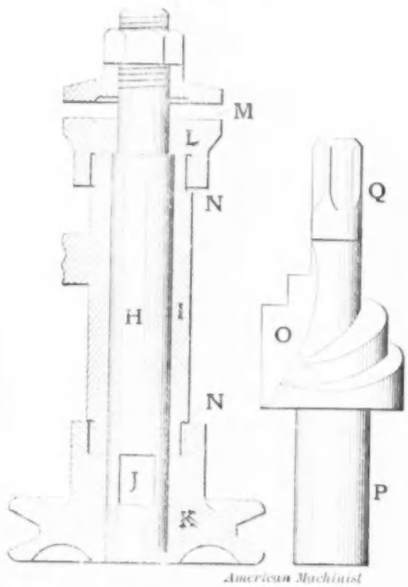

Fig. 5 Fig. 6

AN EMERY WHEEL ARBOR AND ONE OF THE TOOLS USED IN MAKING IT.

on centers, then stained with blue vitriol and stoned down for clearance, rather than ground, as usual. It will naturally come a little convex, and be much better than the concave form left by the grinding wheel.

Chicago, Ill.

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Swedish Wood Working Machinery.

BY JOHN E. SWEET.

Through the kindness of the builders, the J. & C. G Bolinder's Company, of Stockholm, I am able to send you photographs of some of the wood-working machinery which was mentioned in one of my letters of last summer as the best I had ever seen.

As shown in Fig. 1 the resawing machine bed is cast in one piece and looks a good deal as if it had been designed by a machine tool builder.

The feeding apparatus consists of a grooved roller of large dimensions which is powerfully pressed against the board by means of weights, which are so regulated as to give any desired pressure. The pressure on the opposite side is received by two wheels adjustable toward and from each other and toward and from the table. These wheels are also adjustable 'fore and aft the center of the feeding roller. In this manner the workman is enabled to regulate the feed of the board while the machine is running, so that the saw-blade will work easily and exactly, even if the teeth are blunter on one side than on the other. On both sides of the place where the saw-blade works there are adjustable pressure rollers which hold the board steady, even if the feeding roller is removed. Both feeding roller and pressure rollers may, independent of each other, be adjusted to different angles for sawing boards thinner at one edge than the other. For moving the feeding roller there is both a treadle and a handle, and for moving the frame of the pressure wheel there is a hand wheel with crank which can be locked by means of a hand nut for desired dimensions, this hand wheel being easy of access from the front of the machine.

The saw spindle runs in self-oiling bearings, adjustable toward and from the feeding roller for different dimensions of saws, while the front table may be easily turned away to facilitate the exchange of saws. The gearing is inside the front-foot of the frame, and is completely protected from sawdust and the like, but it is still easy of access. There are four different feeding speeds, varying from 60 to 150 feet per minute. The greatest distance between the rollers and the guide is 4 inches on each side of the saw. The driving pulley is 12½ by 7 inches, making 1,200 revolutions with a 30-inch saw. The machine is about 4 by 5½ feet, weighs a ton and a half and takes from 14 to 18 horse-power to drive it.

In Fig. 2 is shown a very complete wood-planing machine, which will strike your readers as peculiar, inasmuch as it will take in only narrow boards or timber up to 12 inches wide by 5 inches thick. Why such a machine can find a market is explainable by the fact that in no country but this are wide boards a common thing. The native trees are usually small and the imported timber comes in the form of deals, pieces 3 inches by 12 inches, which are split into boards by such a resawing machine as before described.

Aside from the above-mentioned feature and the large feed rolls, of which it will be seen there are four pairs, the machine has a familiar look, and yet the similarity to our machines is only in looks, for in no other respect have our regular American makers of wood planing machines followed the Swedish models. The machine is designed to do an enormous amount of accurate work, having five revolving and five fixed cutters or smoothing planes for finishing all four sides, the extra cutter being sharpened while the others are in use. The four sets of feed rollers are driven by worm gearing and the worms by a variable friction drive, giving a feed which is variable from 5 to 160 feet per minute, regulated by a hand wheel on the front of the machine.

The board or whatever is to be dressed is fed to the machine *best side down*, and the first revolving cutter dresses the lower side, the cut being only enough to take off the roughness caused by sawing, with a tendency to straighten the piece. This first revolving cutter is held in a frame which, after the belt is shifted to the loose pulley, can be drawn out in front and a new cutter head be substituted in a moment. In the case of the fixed cutters it will be seen that there are two drawers which slide in on round bars as guides. These bars are flatted on one side so that when rotated flat side up the fixed cutters are dropped down and can be withdrawn and replaced and then raised into position by again rotating the bars. The reason for having two fixed cutters and quick changes comes from the fact that the fixed cutters will not hold an edge for over fifteen minutes. While one is in use its mate is being sharpened; when it is returned to place, brought into position and found to be working properly, then the first one is lowered, taken out and its knife

FIG. 1.—RESAWING MACHINE.

put in condition, and all without stopping the machine. Following the facers are the edgers, which in the case of floor boards or ceiling stuff gage from the face side, so that in the case of tongued and grooved boards the matching brings the surface true even if the board is too thin. The thicknessing is done on the top side, cutting away the poorest part of the piece to bring it to thickness where our machines cut away the best; or, if the board is too thin, it is the poor side that is left rough by this machine, instead of the best, as with us. The above gives but a few of the ingenious points in the machine; for instance, the two pairs of feeding rolls are driven by one worm gear, the four being geared together. To permit the feed rolls to raise and lower for thick and thin stuff, the upper rolls are hung in yokes which pivot on fixed centers, around which the intermediate gears work, and thus the gears are always in proper contact.

The gears are all covered with nice cast-iron shields; in fact, the design is well thought out and the framing round cornered and smooth. Mr. G. Westman is the designer and patentee.

[We regret that our half-tones do not adequately reproduce the photographs sent us by Professor Sweet, which are superb.—Ed.]

Storing and Indexing Patterns.

BY OSCAR E. PERRIGO.

In every large establishment manufacturing machinery there are hundreds and often thousands of patterns of every size, form and cost, from which a large variety of castings are made from a variety of materials. To take proper care of such a multitude of costly patterns and to handle them in the every-day routine of work necessitates a system more or less elaborate, according to the number of patterns, the variety of work and the diversity of material cast from them.

After trying and rejecting various systems for accomplishing these results during the past twenty years the following system seems to me to be the best adapted to the usual conditions, and it may prove interesting to some of your readers who have charge of similar work.

It is necessary, of course, to have the patterns properly housed so as to be protected from undue moisture; to be so placed that no unnecessary strain will warp them, as some may lie for months without use; to have them so ready of access that the person in charge may readily find any given pattern with the least delay; to so mark each individual pattern that the machine to which it belongs and its particular place in that machine may be readily known, and that it may invariably be cast of the proper material.

The "pattern loft," so called, should be so divided that large, heavy patterns may occupy, say one-half, more or less, of the floor space, according to the proportion of heavy and light patterns used. Very long patterns, such as lathe beds, etc., may be placed on brackets projecting from the walls or suspended from wooden hangers spiked or bolted to the overhead timbers and having mortices in their lower ends, through which wooden bars are placed after the pattern is swung up between them. In this manner long patterns may be safely preserved without warping for years, the hangers, of course, being placed near enough together to prevent sagging. Besides being overhead the floor space is saved for large, heavy patterns, which should be carefully wedged up so as to prevent warping, as a little inattention to this matter will be likely to prove expensive, particularly if a pattern remains long unused.

For small and medium size patterns the racks should be arranged projecting from the wall, along one side of the loft, so as to form alcoves, the shelves from 15 inches to 30 inches apart, beginning at the floor, and from 2 to 4 feet wide, with a

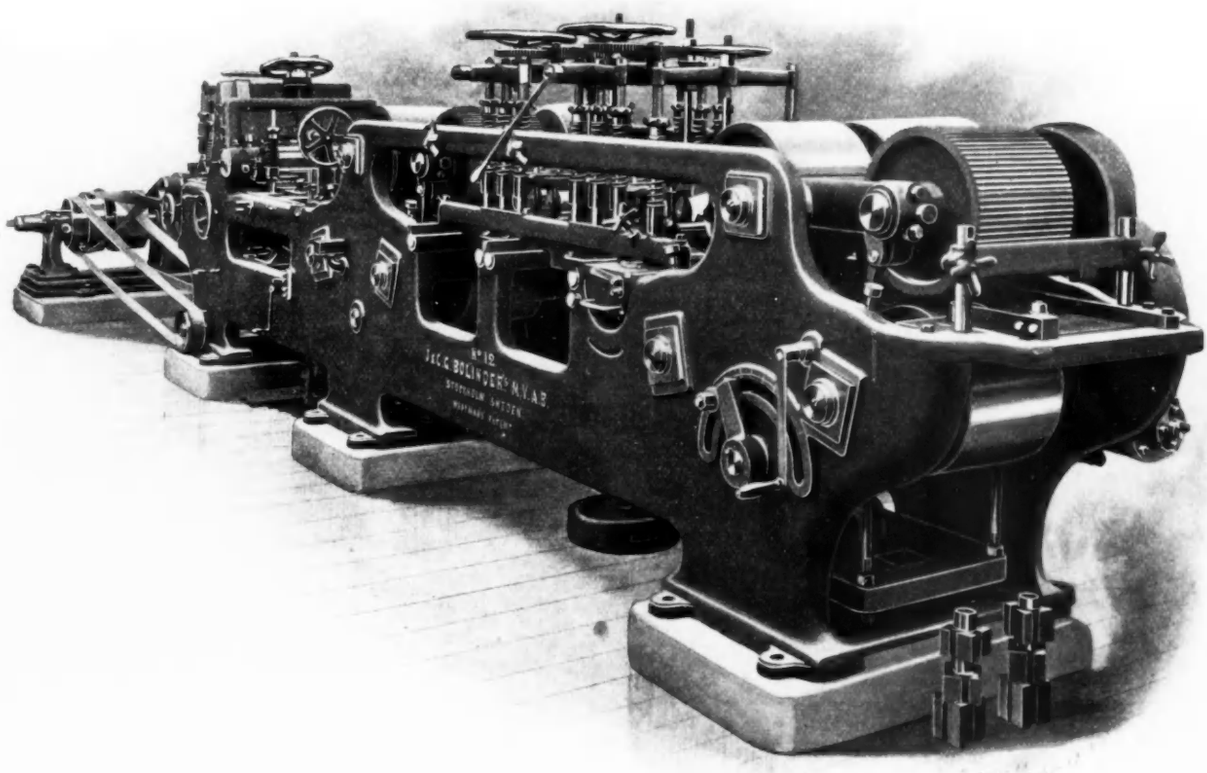

FIG. 2.—WOOD PLANING MACHINE.

passage of from 2 to 4 feet between them. This will give ready access to both sides of the shelves.

As far as possible each tier should be devoted to a single machine, though in machines of few patterns two or three, or even one shelf, may be so assigned. The name or other designation of the machine should be marked with black shellac on a light shellacked strip of wood and nailed to the edge of the shelf. As to the designation of individual patterns I have found it the most satisfactory to have a letter of the alphabet designate each machine. In case the shop regularly builds more than twenty-five machines double the letters. For a series of machines of the same style and class, but of different sizes, the patterns are numbered in a series from 1 upward, the *same number* indicating a *similar piece* in all the machines, the *machine* to which it belongs being indicated by the *letter*. For practical use a convenient table is made and blue printed, as in the table, say for a series of lathes.

No.	PIECE.	Swing.	12"	14"	16"	18"	20"	24"	28"	32"	38"	45"	50"	60"
		Letter.	A	B	C	D	E	F	G	H	I	J	K	L
1	Bed		1	1	1	1	1	1	1	1	1	1	1	1
2	Cabinets		2	2	2	2	2	2	2	2	2	—	—	—
3	Cabinet Doors		—	—	1	1	1	1	1	1	1	—	—	—
4	Center Legs		?	?	?	?	?	?	?	?	?	—	—	—
5	Head		1	1	1	1	1	1	1	1	1	1		1

FORM OF PATTERN LIST.

The numbers in the squares under the designating letter indicate the number of castings from each pattern. In machines not using a particular part a dash is placed to show it. If the number is left to be determined by the order for any particular length of bed, or similar circumstance, an interrogation point calls attention to the fact.

This system requires each pattern to be marked with raised letters and figures. Ordinarily one-half inch sharp face Gothic is suitable, as for instance **B5**. If a certain pattern is used in two machines it may be marked **B5C**. If on improving or changing machines the pattern requires to be altered an **X** is added to its designation (this letter having been reserved for this purpose), the mark becoming, say **B5X**; a second change adds another **B5XX**. In furnishing repairs the customer can tell just the part he wants by quoting these marks, which is often a matter of great convenience in correspondence.

To show the material of which the piece is to be cast the following method has been found to be the most simple and certain: Let the *color* of the pattern denote the material. For gray iron castings, black; for steel castings, blue; for malleable iron castings, brown; for brass castings, yellow; for bronze, or similar castings of a better quality than ordinary brass, orange. For all core prints, red. If a pattern is in two or more parts let the surfaces that come together be shellacked light. These colors have been in use for seven years, and in not a single instance has the piece been cast of the wrong material. The above colors may be readily made by adding dry vermilion, chrome yellow, ultramarine blue or burnt umber to ordinary shellac varnish. To make orange add a small portion of red varnish as already made.

In ordering castings from the foundry there should be duplicate slips, as shown below, made up from the blue printed tables. One of these is retained by the man in charge of orders, and the other given to the foundry, the number secured being checked off as the castings are received. A column of weights of pieces may be added if necessary.

CASTING ORDER.

Date,

For Order No......

.....

Patt. No.	PIECE.	No. Wanted	No. Received

CASTING ORDER.

Date,

Please make the following Castings and deliver them as the number required of each piece is complete.

For Order No......

Patt. No.	PIECE.	No. Wanted	No. Made

ORDER SLIPS.

While all of the suggestions herein made will not apply to any one shop, it is hoped that there may be some of them found of practical utility in the every-day routine of business of caring for patterns and producing with economy and certainty the right castings, of the right materials every time.

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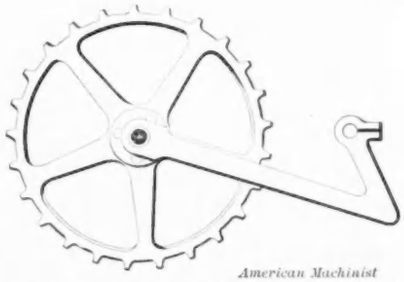
"Good for Hill Climbing."

No matter what kind of a contraption may be put onto a bicycle, riders can always be found to declare it the greatest thing on earth. The "American Wheelman," under the head of "Transatlantic Inventions," publishes the following:

"The crank shown in the cut has been in use in England over a year, and the manufacturers have many letters from riders who speak of it in terms of praise. By this arrangement an 8-inch lever is made to receive the thrust of the cyclist, the throw of the foot remaining 6½ inches. The effect is said to be a large increase of power below the center where the cyclist can do most with it, and, by clawing and ankle motion, a similar increase all round. One of the writers of the letters above referred to says: 'Near Crouch End, where I live when in England, I had always tried to go up Muswell Hill, and had never succeeded with my old cranks. Every time I have tried to do it with your new cranks I have been right at the top.'"



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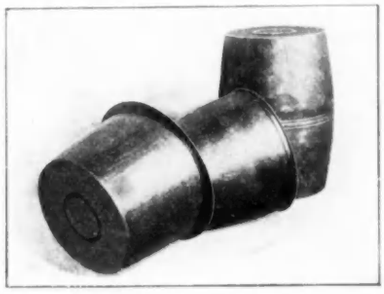
A CRANK BY WHICH "LEVERAGE" IS GAINED.

It ought to be clear to the meanest intellect that there is no use stopping at an 8-inch leverage. The crank hanger can be raised to make 24-inch levers clear the ground, and then by returning the point of attachment for the pedals to within an inch of the center of the shaft a rider would only have to wiggle his toes a little bit to attain the cyclist's dream of a mile a minute up hill and down. The leverage would do the business. Leverage will do almost anything, if you only know how to work it, and there are many people who not only accept Archimedes' statement regarding his ability to move the earth with a lever, if only he had a place to stand on, but they believe that a man could move the earth at the rate of 40 miles a minute if only he could obtain enough "leverage."

A Large Spinning Lathe.

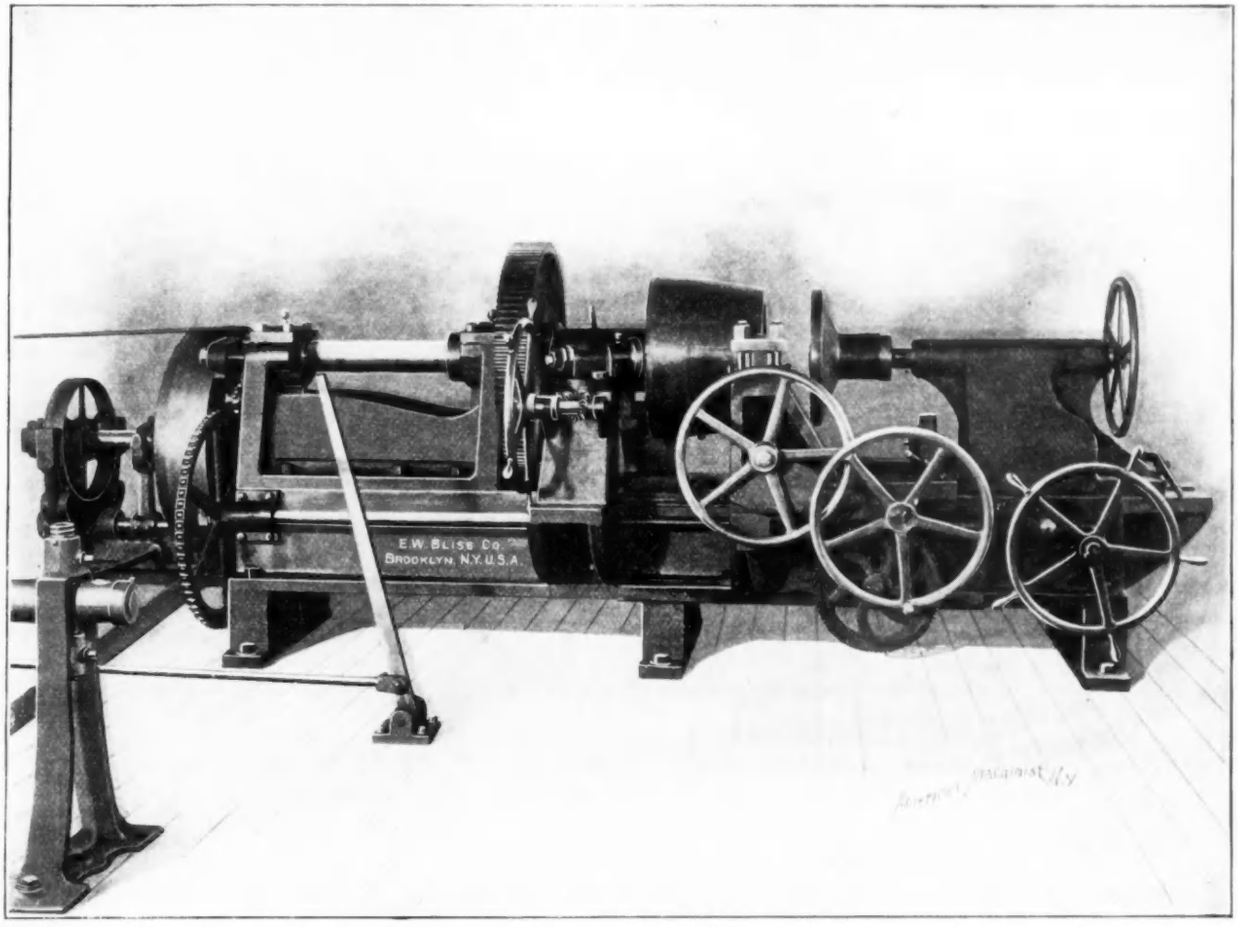
The lathe we illustrate on this page is one of a complete series of machines for a new line of manufacture, and it has been built for a French concern. The special duty of this lathe is to finish the shaping of the halves of steel barrels which are to be used for the transportation of petroleum. Two finished halves of a barrel and a barrel complete are shown in the small half-tone. These halves are first drawn from the sheet by a series of operations with an enormous hydraulic press; but, while the press does its work well, the dies leave the sides of the shells full of creases, and it is the work of this lathe to smooth out the creases and to finish the flanges ready for the double-seaming operation, done in another special lathe, which locks the halves together and completes the barrel.

The main spindle of the lathe is driven by the large pulley at the back end, which runs constantly. The lever in the foreground operates a friction clutch, which drives the pulley shaft, and a pinion on that shaft engages with the big gear on the main spindle. The reverse movement of the lever, which throws out the clutch, also, if continued a little further, operates a brake on the smaller pulley at the extreme left and instantly stops the lathe. On the main spindle is mounted a former of the precise shape of the inside of the half barrel. A ball bearing is provided behind this former to take the thrust. The half barrel as it comes from the press is placed over the former, the tailstock is run up by the hand wheel at the extreme right, large pins are dropped into the ways for the tailstock to back against; it is fastened by the clamp, which is wisely put in front; the tail spindle is run forward, and the revolving pressure plate, which also has a ball bearing behind it, is held tight against the barrel head, and the spinning operation then begins.



A STEEL BARREL AND ITS HALVES.

This operation consists in traversing the entire periphery of the half barrel with a hardened, round-faced steel roller which successively presses every portion of the metal to contact with the former, and leaves the outside smooth, or with a slight trace of the roller path, the pitch of which is about eight to the inch. The cross-screw of the rest, with the large hand wheel upon it, operates only to pull back or withdraw the spinning roller, and does not apply the pressure for the spinning. This is done by a heavy weight at the back of the lathe, and a chain attached to the roll carrier and passing over a sheave. The use of the weight maintains a uniform pressure on the roll, and at the same time allows it to move back as the rest advances and the diameter increases. When the flange is reached the feed is thrown out automatically, and the rest is held in position until the flange is flatted, which is done by another roller which stands obliquely to the spindle and is fed along by the large hand wheel near the main gear. The edge of the flange is finally trimmed off (there being always some irregularity and some surplus), by means of revolving shearing cutters at the back of the lathe. This lathe, and the entire set of machinery here referred to, was made by the E. W. Bliss Company, Brooklyn, N. Y.

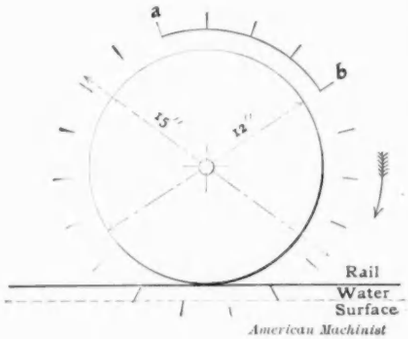


A SPINNING LATHE FOR STEEL BARRELS.

Paddle Wheels.

BY W. H. BOOTH.

A very prevalent fallacy which deserves notice is that an ordinary radial float paddle wheel is so very much worse than the feathering wheel. If an ordinary wheel be revolved in a fixed vessel of water, the radial floats will appear at their worst and feathering paddles will appear to be most essential. But this is not the way to study a paddle wheel. We must consider that the wheel is moving forward over the water, and that in doing so the floats naturally have a natural angle of entry which is very much more favorable than appears in a fixed tank trial. The slip of a paddle wheel is from 15 to 20 per cent. If therefore we wish to try the effect of a model let us take a wheel of 15 inches diameter and on each side thereof fix rollers of 12 inches, as in the sketch. These rollers are to run upon rails, while the 15-inch diameter float wheel dips in the water. If now this wheel be rolled upon the rail the true effect of the entering float will be made much clearer. The apparent backward speed of the 15-inch floats will



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be modified by the forward run of the 12-inch rollers upon the rail, and the floats will be seen to enter the water very much more gently than when the wheel is revolved on an axle. The roller gives the forward movement of the vessel supposed to carry the wheel, and this is not sufficiently considered by those who wonder why feathering floats are not so common as they might be. Conversely, the disadvantage of radial floats in leaving the water is less than appears with an imperfectly arranged model. Having got so far, we may now revert to the fixed axis model and reduce the speed of revolution to one-fifth, and note we get of course so much less disturbance than when we revolve at full speed. It is the small speed that really represents the true case.

If the inside ends of the floats were boxed together, as suggested and shown at *a b*, it is obvious that the water in these chambers would not leave them readily, and a wheel would be exposed to great shocks. Yet this construction has been recently suggested. A wave rising under the wheel would develop enormous force against the boxes, and this alone would prevent their use if not radically bad in other respects. Hence the very open style of paddle wheels which are designed to give a horizontal movement to as large a mass of water as possible, but to interfere as little as possible with the undulatory movements.

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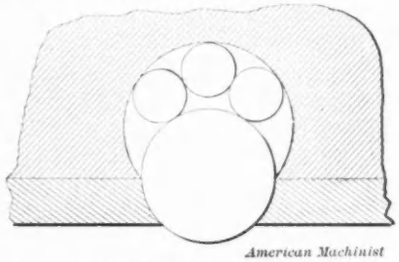
Governmental Demoralization of Patent Solicitors.

It is not necessary for us to say a word as to our appreciation of the United States patent laws, or of our unwavering conviction that they have been a most powerful stimulant and promoter of our national industries. We believe that the good work of the Patent Office is by no means all done, and therefore it is that we would have it as free as possible from reproach. We respect also the patent agent as a necessary co-operator to the success of the patent system. There is no more honorable occupation if legitimately followed, and the faithful and upright practitioner is not too well paid at the best.

It is, however, a fact which will not be disputed, that there are so-called patent solicitors who perform no useful function, but are prolific only of evil, who bring reproach upon the profession, and whose extirpation would be a blessing to the community. As these columns have pointed out before, these creatures are the product of opportunity. Some of these malignant opportunities it is perhaps impossible to eliminate, while there are others whose active existence should cause constant astonishment. Human nature is what it is. The typical and too common type of inventor is sanguine and credulous, and usually grossly uninformed as to patent practice and routine. Many have an unwarrantable faith in the value of a patent merely as such, and are quite regardless of what it may cover or whether it covers anything, as in too many cases it practically does not. The wily "patent solicitor," as far as we can see, must continue to solicit such as these, and suck their blood and wax fat.

He should not, however, have the connivance and practical assistance in his nefarious calling of the organized force of the Patent Office. The patent laws are for the purpose of securing temporarily to the inventor his property in any useful invention, so that he may be encouraged and rewarded, and so that in the end the entire community may reap the benefit. The Patent Office professes to deal only with useful inventions, and those which are not useful and which are of no value it has no proper business to protect. The question of utility is found in practice to be one not easy of determination. It is therefore interpreted "liberally," and liberality, here as elsewhere in the interpretation of the laws, is not synonymous with exact justice.

This, however, is not the point to which at present we wish to call attention. The question of utility may always be a debatable one. A thing that is useless to-day may be of great use in the further developed practice of to-morrow. But a thing to be patented should at least do, or be able to do, what it claims and is represented to do. There is something wrong when patents are allowed to issue for devices which actually will not work. Such patents are sometimes issued, the patentee is victimized, the patent solicitor receives his unjust reward, and why is it not with the connivance and assistance of the patent examiner? We have not far to look for an illustration. Within the present year a patent was issued for a so-called "roller skate." It was not properly a roller skate, as a large ball took the place of each bearing roller, but we are not picking a quarrel upon that point. But there was provided a circular cavity down through which the large ball partially protruded and above it were two other balls, separated laterally from each other, and both touching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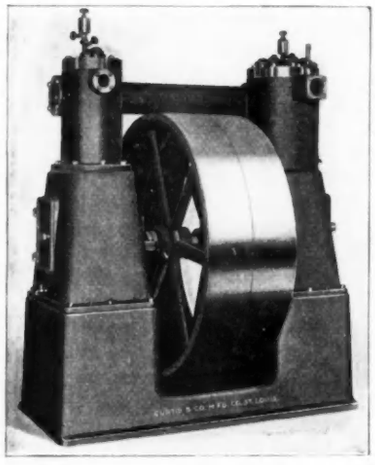
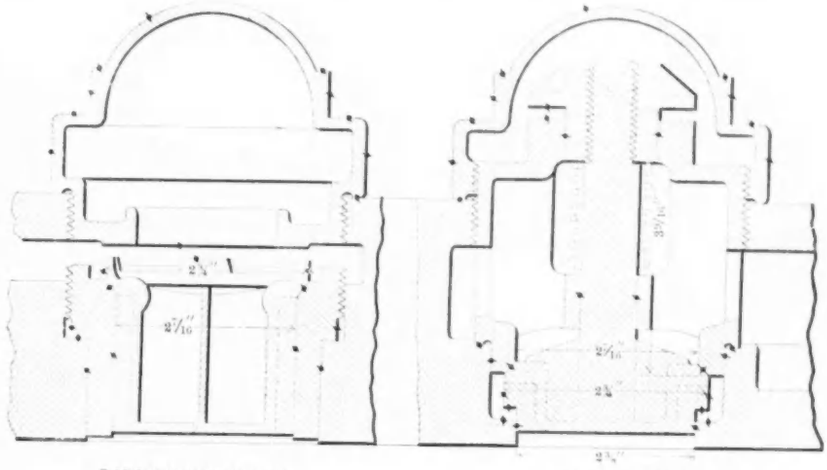
A PATENTED BALL BEARING FOR A SKATE.

the large ball below and the interior of the circular cavity above, with a third ball between these two touching each and also touching the same inner circular surface. These balls (see sketch) were all in the same vertical plane, the central plane of the skate. The impossibility of the balls rolling continuously or of performing the anti-friction function claimed for them is evident. Yet this is a patent issued by the United States Patent Office for a *useful* invention. After seventeen years all the people will be at liberty to use it without asking the inventor's leave. If patents such as this are procurable there will always be patent attorneys who will undertake the task of working them through the office. It would be interesting to get some insight into the mysterious system which permits the issue of such an extraordinary patent as this, which, unfortunately, is far from being the only one which has issued for a self-evident impossibility. It is no wonder that the "no patent no pay" attorneys flourish. The chances seem to favor their success. The fact that the United States Government will issue a patent on such a thing as this results in but one thing. It enables the

patent solicitor and the Government aforesaid both to get money from a man, and for the money to give absolutely nothing of value in return.



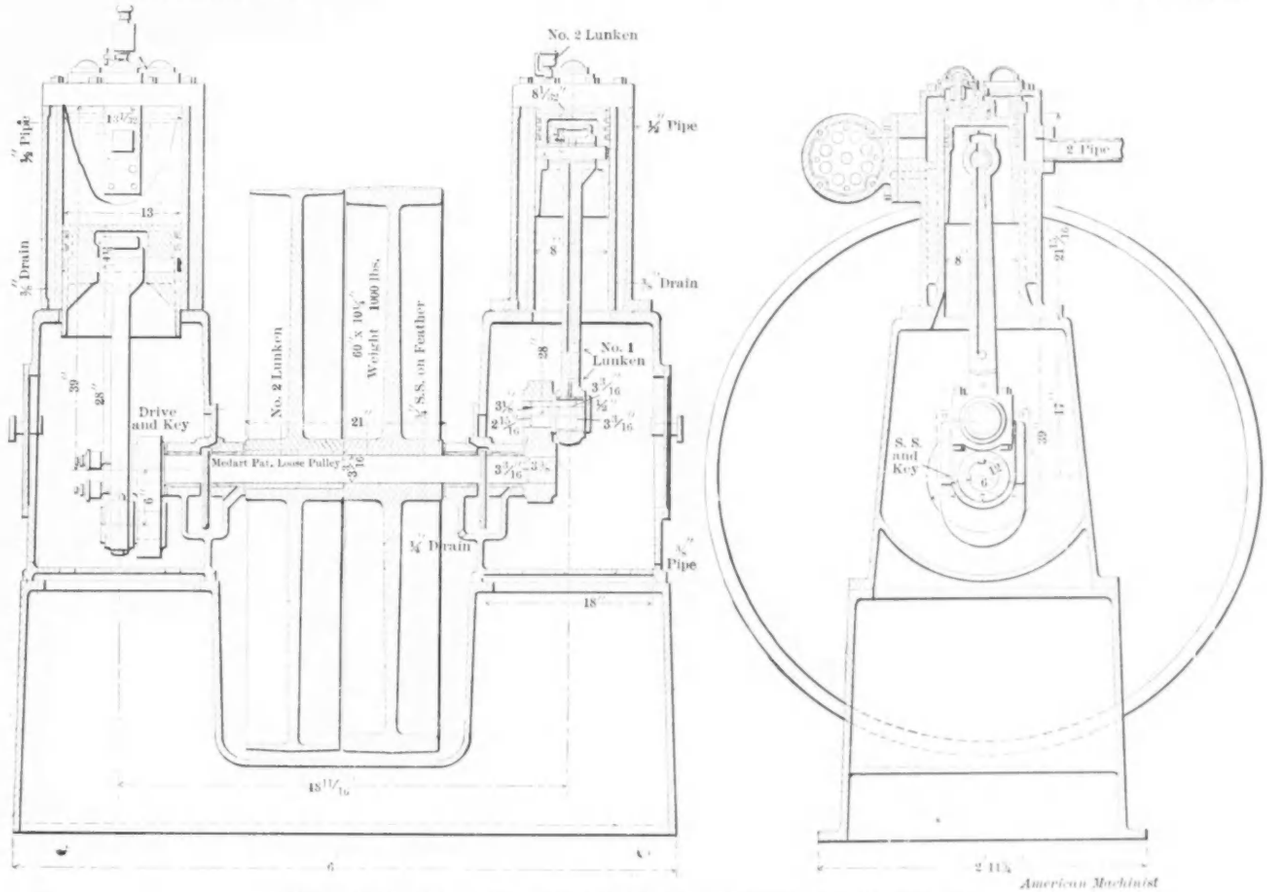
AUTOMATIC BELT DRIVEN TWO STAGE AIR COMPRESSOR.



DISCHARGE VALVE

INLET VALVE

American Machinist



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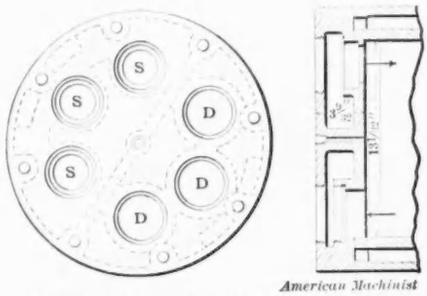
VERTICAL SECTIONS OF TWO STAGE BELT DRIVEN AIR COMPRESSOR.

A Belt Driven Air Compressor for Shop Service.

The half-tone and accompanying drawings illustrate an air compressor especially designed for the constant maintenance of a working supply of compressed air in machine shops, boiler shops, foundries and similar places where it is the growing practice to employ air operated tools and facilities. The compressor is of the belt-driven type, with tight and loose pulleys for easy stopping and starting. It is designed to be usually kept constantly running, a pressure governor automatically operating a run-around which stops the operation of compression when the pressure rises above a given point and allows it to resume again when the pressure falls. The compression is in two stages, with an efficient intercooler between the cylinders. The diameters of the cylinders, each single acting, are respectively 13 inches and 8 inches, with a stroke of 12 inches, and the free air capacity at 110 revolutions per minute is 100 cubic feet per minute, the permissible pressure being 100 pounds gage, although 75 or 80 is the more common practice. The pulleys are 60x10¼ inches, and the belt may lead off in any direction most convenient, the revolution being in either direction.

As will be seen, the compressor is entirely inclosed, but the working parts are easily accessible. By the hinged door at each side the connecting rods, cranks and main bearings are reached, and all the

valves are in the cylinder heads, each valve having its own cap and being independently removable. In the half-tone the high pressure cylinder is nearest the observer, and the air is discharged at the side flange to which the pipe to the receiver or line is to be attached. The free air centers at the side flange of the other



HEAD OF LOW PRESSURE CYLINDER.

cylinder, and if for any reason desirable an air pipe from the outside of the building or elsewhere may be connected. The provision for the lubrication of every working part is deserving of notice. There are chain oilers on the main journals and a pressure grease cup takes care of the upper pin. The base of the compressor is 6x3 feet and the total hight is 7 feet. The drawings give very clear information as to the construction and operation of this compressor. It is built by the Curtis & Co. Manufacturing Company, St. Louis, Mo.

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The Determination of the Size and Number of Turns of Wire in a Constant Potential Generator.

BY WILLIAM BAXTER, JR.

An electric generator may be compared with a steam boiler and an electric motor with a steam engine. The boiler generates steam, and the engine utilizes it. A generator generates electric currents, and the motor utilizes them. The boiler must maintain the pressure steadily or the work of the engine will not be satisfactory, and this is also the case with the generator. The pressure of the boiler is kept uniform by the care of the fireman; but such a method, although possible with the generator, would not give very satisfactory results, owing to the fact that the changes in pressure are practically instantaneous, and, consequently, even with the greatest vigilance, the attendant could not follow them up close enough to keep the fluctuations within permissible limits. Fortunately, the principles upon which electric generators act are such that the machine can be made self-regulating by the simple expedient of winding it with wire of a certain size and a certain number of turns. A machine so wound is called a constant-potential generator. It will maintain the pressure constant, because it acts simultaneously with the causes that tend to vary the pressure.

The rules by which the proportions of the wire are determined are very simple and could be given in a few words, but when anyone uses rules without understanding the principles upon which they are based, he is liable to make serious errors, and without being conscious of the fact; it is therefore best to become familiar with the principles, especially when this knowledge can be acquired with a moderate amount of mental effort.

Figs. 1 and 2 illustrate the winding of constant-potential generators, Fig. 1 showing the shunt winding and Fig. 2 the compound. The shunt winding will not maintain the pressure perfectly constant, but can be made to approach very nearly to it. The compound winding can come nearer to absolute constancy than the shunt, but neither one can maintain perfect constancy, either in theory or practice, although the actual departure therefrom may be made very small. The armature is shown at *A*, the commutator at *C* and the brushes at *a b*. To obtain a constant pressure from an armature it is necessary that the strength of the magnetism developed by the field magnets, and the speed, remain constant. The field magnetism can be kept constant, in a manner hereafter to be explained; therefore, if the speed does not change, the pressure will not change. Although under the above conditions the pressure developed will not change, the portion of this pressure that can be made use of will change with variations in strength of current; that is, the pressure developed by the armature will remain constant, but that appearing at the brushes will vary. The reason for this difference is that the wire on the armature resists the passage of the current through it, and a part of the pressure generated is used to overcome this resistance, the remainder only appearing at the brushes, and the stronger the current the greater the amount of pressure used up in the armature. If the resistance of the armature is, say, 1 ohm and the current 1 ampere, a pressure of 1 volt will be lost in overcoming this resistance. If the current is increased to 10 amperes, the pressure lost in the armature will be 10 volts, and if the current is 50 amperes, 50 volts. Under the above conditions, if the armature develops a pressure of 100 volts, the actual pressure appearing at the brushes will be 99 volts when the current is 1 ampere, 90 volts when it is 10 amperes and 50 volts when it is 50 amperes. Now suppose that the resistance of the armature is one one-hundredth of an ohm instead of 1 ohm; then, when the current is 1 ampere, the loss of pressure in the armature will be one one-hundredth of a volt, and the pressure appearing at the brushes will be 99.99 volts. When the current is 10 amperes, the loss of pressure will be one-tenth of a volt, and at the brushes we will have 99.90 volts, and when the current is 50 amperes, the loss in the armature will be one-half of a volt and the pressure at the brushes 99.50 volts. From these simple illustrations we see that the lower the resistance of the armature the smaller the loss of pressure in it, and, therefore, the nearer uniform the pressure appearing at the brushes; hence the first requisite of a constant-potential generator is that the armature resistance be made as low as possible. The resistance of a wire is proportional to its diameter and its length. Increasing the length increases the resistance, and reducing the diameter increases the resistance. Shortening the wire and increasing its diameter reduces its resistance; therefore, to reduce the resistance of the armature it is necessary to make the wire as large and as short as possible. Shortening the wire reduces the number of turns it makes around the armature, and as the pressure developed is proportional to the speed, the strength of the field and the number of turns of wire on the armature, a reduction of the number of turns will reduce the pressure, unless the reduction is compensated for by an increase in strength of field or in speed. From this it will be seen that if the machine is run at the same velocity, reducing the armature resistance reduces the capacity; but as practice shows it is possible to make the armature resistance low enough to secure good regulation without reducing the capacity of the machine to any serious extent.

In the foregoing we have shown how to develop a practically constant pressure, on the assumption that the speed and the strength of the field remain constant. For constancy of speed we depend upon the governor of the steam engine; for constancy of field strength we depend upon the constancy of the current pressure, as will appear from the following:

In Fig. 1 *S S* represent the coils that magnetize the field. The current generated by the armature passes out through brush *a*, and at *B* it finds two paths into which it may pass, one by *P* to the external circuit, through which it returns to *N* and thence to *E*. The other path is through the coils *S S*. The two currents separate at *B* and come together at *E*; from there they flow, as one, to brush *b* and back to the armature. As the wire in the coils *S S* cannot change its resistance, the current passing through it must remain constant, the pressure being constant; therefore, the magnetizing force acting upon the field will remain constant, and so will the strength of the field. The current passing to the external circuit will change whenever the

resistance in that circuit changes; but this will have no effect upon the current through the coils, as that is governed wholly by the pressure at the brushes, and can only change when this pressure changes; but this pressure does not change from this cause, which can thus have no direct effect on the current in *S S*. If the armature had no resistance, the pressure appearing at the brushes would be the total pressure generated, whether the current were weak or strong; but as it is impossible to construct an armature without some resistance, the pressure at the brushes, that drives the current through the field coils will necessarily drop a little as the current delivered by the armature increases; therefore, the current through *S S* will gradually reduce as the load on the generator is increased. From this we can see that there are two ways in which the pressure is decreased as the current increases. One is by the greater amount of pressure lost in overcoming the armature resistance and the other by the reduction in the current passing through the coils *S S*. As already shown, if the armature resistance is one one-hundredth of an ohm, the pressure at the brushes will drop only half of a volt when the current increases to 50 amperes, so that at this point the pressure acting to drive a current through the coils *S S* will be 99.50 instead of 100 volts; therefore, the strength of the field will be about half of 1 per cent. less, and this will cause a further drop in the armature pressure of about one-half of 1 per cent., making the total variation in pressure between no current and 50 amperes about 1 per cent.

If the current is to be used at some distance from the generator, a portion of the pressure will be lost in overcoming the resistance of the line wires, and this loss, which is called the drop on the line, will increase with the current, being very little with a weak current, but sufficient to be objectionable with a strong current. A better idea of the loss of pressure with increasing current, both in the armature and line, can be had from Fig. 3. In this diagram the horizontal lines represent pressure and the vertical ones current. If the loss of pressure in the armature increases with the rise in current, as indicated by the line *R*, the useful pressure of the machine will appear to drop, and instead of being 100 volts for all strengths of current, as indicated by the line *A*, would be gradually less, and conform to the line *B*. If the loss of pressure in the line were equal to the difference between the slope of lines *R* and *L*, then the drop in the pressure of the current at the point of distribution would be as indicated by the line *C*. Now, it is evident that if we can so arrange the armature that the actual pressure will rise as the current increases, so as to follow the line *D*, which is at the same slope as *R*, the loss in the armature will be compensated for and the pressure at the brushes will be 100 volts with any current, from the strongest to the weakest. If the rise in the actual pressure is in accordance with the line *E*, which has the same slope as *L*, the pressure at the point of distribution will be constant. Both these results can be accomplished with sufficient accuracy for practical purposes by the compound winding, shown in Fig. 2. The difference between this winding and the shunt is that in addtion to the shunt coils there are other coils through which all the current of the machine passes. These coils help the shunt coils to magnetize the field, and it will be seen that as the current in them is variable in strength, they will help only slightly when the current generated is small and a great deal when it is strong. The effect of this is that the greater the current generated the stronger the magnetic field, and, therefore, the greater the actual or total pressure developed in the armature. If the coils *D*, through which all the current passes, have but a few turns their assistance will be slight; if they have many turns it will be considerable. If only the loss of pressure in the armature is to be compensated for a few turns will be sufficient; but if the pressure is to be maintained constant at the end of a long line, more turns will be required; the number increasing as the line resistance increases. The size of the wire in the shunt coils *S S* and the number of turns, as well as the number of turns in the coils *D D*, can be easily ascertained by calculation, and this is always done when a machine is designed, so that the proper amount of space may be provided for the accommodation of the wire; but when the first machine is finished, all but the field coils, the actual proportions of these are determined in an experimental way, as follows:

Temporary coils are wound upon the machine, the wire being of any convenient size. The armature is set in motion at the proper velocity, and a current is passed through the temporary coils from another machine. This current is gradually increased until the armature develops the required pressure with a very weak current. The current passing through the coils at this stage of the experiment is noted, and then the current is increased until the armature develops the pressure required when it is generating the maximum current. The current in the temporary coils is again noted at this point.

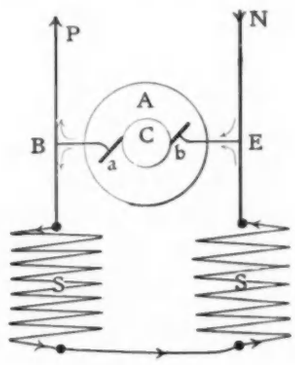

Fig. 1

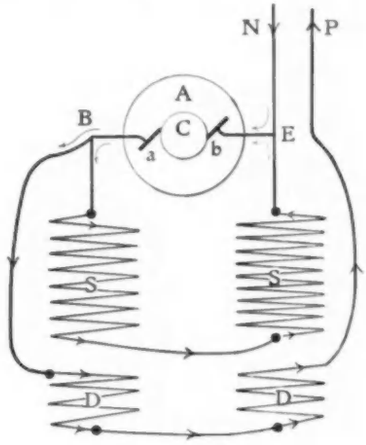

Fig. 2

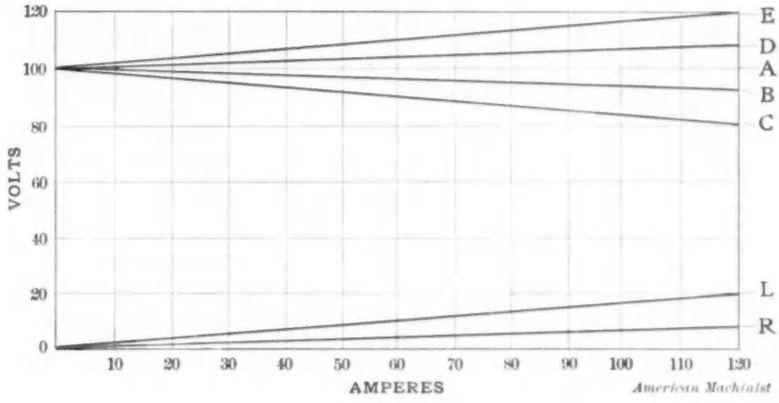

Fig. 3

WINDING A CONSTANT POTENTIAL GENERATOR.

In this way the magnetizing current required, when the armature current is very weak, is ascertained, and also the extent to which it must be increased to enable the armature to develop the required pressure when the current it is generating is the maximum. The first reading gives the magnetizing force of the shunt coils *S S* and the second that of the coils *D D*, which are called series coils. With this information at hand, it becomes a very simple matter to determine the size wire for the shunt coils and also the number of turns and size of wire for the series coils. How this is done will be explained in another article, in which will also be explained the method of calculating the dimensions of wire for constant-speed motors.

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The Diesel Motor.

This gas and petroleum engine has attracted a great deal of attention in Europe, and is beginning to receive simi-

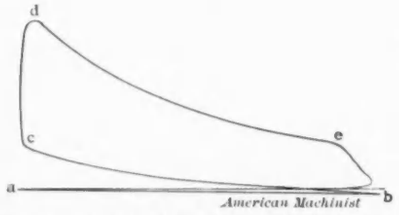


FIG. 1.—INDICATOR CARD FROM STANDARD TYPE OF GAS ENGINE.

lar consideration in this country, and it seems proper that we should devote some space to an explanation of its peculiar features. Appearances indicate that it embodies an important step in the development of the gas engine. It is the result of a long, laborious and expensive series of experiments, the object of which was to embody in constructive form the features shown to be desirable by theoretical considerations, and should it prove to be of the importance which those interested in it believe, it will be perhaps one of the most marked cases in

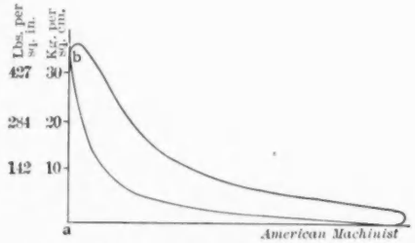


FIG. 2.—INDICATOR CARD FROM DIESEL MOTOR.

history in which theoretical studies have led to practical results.

In order to make plain the differences between this and previous gas engines, it is desirable to turn for a moment to the cycle of action of the standard construction of to-day. Fig. 1 is a representative indicator diagram from an engine working on the Otto cycle. Beginning at *a* during the first out-stroke, the piston draws in the explosive mixture of air and gas. During the returning in-stroke this charge is compressed on the line *b c*, and at the completion of this stroke the charge is fired, when the pressure rises to point *d*. During the second out-stroke the fired gases expand on the line *d e*. Exhaust takes place at *e*, the spent gases being expelled on the second return stroke, and on its completion the cycle begins again by a new charge being drawn in during the following out-stroke. The regulation is accomplished, as is well known, by skipping an explosion occasionally as determined by the governor.

It will be seen that the explosion takes place almost instantaneously while the crank is turning the center, the volume of the gases being the same at the completion of the explosion as at the commencement, or in scientific phrase, the explosion takes place at constant volume. This volume is the clearance space of the engine, which must be large enough to contain the gases at the completion of the compression stroke at a moderate pressure, since any increase in the pressure before explosion is accompanied by a corresponding increase of temperature and pressure after explosion, both of which, the former especially, must be kept down to a point which the engine can endure. The volume of the clearance space will thus be seen to be a certain large fraction of the cylinder volume, determined by the pressure desired to be realized at point *c*. This clearance volume, on the other hand, determines the number of expansions possible, and hence the terminal pressure, since the volume of the gas at the beginning of the power stroke is equal to that of the clearance space and at the end to the volume of the clearance space plus that of the cylinder proper, and the ratio of these volumes cannot be changed except within narrow limits. The number of expansions is thus fixed by the construction of the engine, and is moreover necessarily moderate, as will be seen from the diagram. Moreover, in the nature of the case, the mixture of air and gas must be in such proportions as to be explosive, any excess of air beyond that point stopping the engine.

In consequence of the explosion taking place at constant volume, the work of the heat results in a great increase in the temperature during the explosion. It is at this point that the first great difference in the action of the Diesel motor is found, and to this we will return later. The firing of the charge is done, in other gas engines, by various external means, which it is not necessary to discuss here.

There are two temperatures connected with combustion which it is necessary to note. One is the temperature at which the combustible will ignite, called the temperature of ignition, and the other is the much higher temperature resulting from the combustion, called the temperature of combustion. The temperature of ignition is comparatively low, and, moreover, is dependent on the pressure at which ignition is effected. The temperature of the compressed gas increases with increase of pressure, while this same increase reduces the temperature necessary for ignition, and if the process be carried far enough the two will meet, the compression temperature being then sufficient to ignite the charge without any external agency, and this plan is followed in the Diesel engine. In this engine the cylinder is, however, filled with atmospheric air only during the first out-stroke (corresponding to that from *a* to *b* in Fig. 1), which air is then compressed up to a point the temperature of which is above that necessary for ignition, and after the completion of the compression the gas or oil is introduced in a jet, when it ignites and burns like a common gas or oil

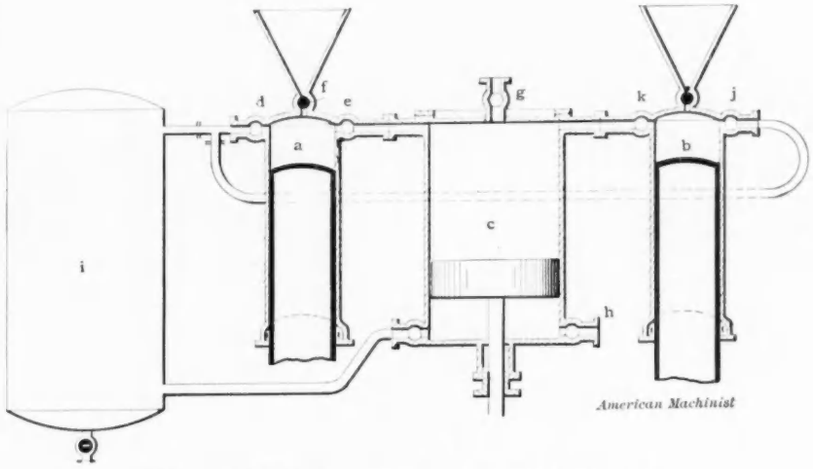


FIG. 3.—DIAGRAM OF COMPOUND DIESEL ENGINE.

burner in the open air. This is the radical feature of the Diesel engine, although all of its consequences are not yet apparent. Fig. 2 shows an indicator card from this engine from which these consequences may be traced. Beginning at *a* (the induction line is not shown in the diagram) atmospheric air is drawn in during the first out-stroke, and on the first in-stroke is compressed to *b*, this pressure being very high—500 pounds or thereabouts per square inch. At *b* the gas or oil jet is opened and the gas or oil enters and immediately ignites. Meanwhile the piston begins its second out-stroke. The action at this point is very peculiar. We ordinarily associate combustion with increase of temperature, but here there is no such increase. Were the compressed air to re-expand without additional heat, the temperature would of course fall, but here the volumes of air and fuel are so regulated to one another that the combustion only serves to maintain the temperature at the point reached at the end of the compression. This action is possible by reason of the control over the proportion of air and fuel in the cylinder.

As has been stated, this proportion in the Otto type of machine must be such as to be explosive, while with the present machine any desired surplus of air may obviously be used. This surplus has another effect in insuring complete combustion, in consequence of which it is claimed that the exhaust of this engine gives out no smoke and very little smell.

The admission of gas continues up to a point determined by the governor, precisely as with a steam engine, when it is cut off and the gases expand, as shown by the diagram, the card as a whole being very similar to that from a steam engine having heavy compression and very early cut off.

The pressure at point *b* is determined in this engine, as in the common form, by the ratio between the cylinder and clearance volumes, and since the pressure here is much higher (500 pounds against 30 or 40), it will be seen that the clearance volume is much less. This again increases the possible number of expansions, as indeed is apparent from comparison of the diagrams. The clearance volume is said to be reduced to 7 per cent. of that of the cylinder.

Such is an outline of the Diesel motor. It will be seen that it gives the promise of a higher fuel efficiency, and especially of better regulation and control than have heretofore been obtained. Regarding the former, the claim is made of 28 per cent. of the fuel value of the gas realized in brake horse-power, against 18 per cent. for other gas engines, and 12 per cent. for the best steam engines. Regarding the latter it is obvious that the cut off regulation must be better than that obtained by skipping strokes, but that in the form so far described, the engine being single acting and having but one effective stroke per two revolutions, the regulation must be inferior to that of steam engines. These advantages are purchased at the expense of very high pressures, and the practicability of these must be determined by experience.

The engine as so far described is in the form intended for small and medium powers. For large powers it is compounded. The first object of compounding is to prolong the expansion, since in spite of the high number of expansions shown by the indicator cards the spent gases are still exhausted at too high a pressure for the best results. A second reason for compounding is to reduce the excessive working strains due to the high initial pressure, and a third reason is to secure better governing. Fig. 3 is a diagrammatic representation of the compound engine. It will be seen that there are two high and one low pressure cylinder, the former being shown at *a b* and the latter at *c*. All are lower end of the low pressure cylinder single acting as regards power, but the is used as an air pump for partial compression of the air, nothing but the gases of combustion finding their way to the upper end of this cylinder. The cranks of the two high pressure cylinders are in line with one another, while the low pressure crank is 180 degrees from the high pressure ones. The valves of the high pressure cylinders are so timed that their effective strokes alternate. Beginning with the high pressure pistons at the top of the cylinders, *a* being charged with compressed air, the low pressure piston is at the bottom. Air valve *d* and exhaust valve *e* are shut and gas valve *f* is open. A power stroke is hence made by cylinder *a*, during which the piston of low pressure cylinder *c* moves upward, expelling its exhaust through valve *g*, while atmospheric air is drawn in through *h*. During the same

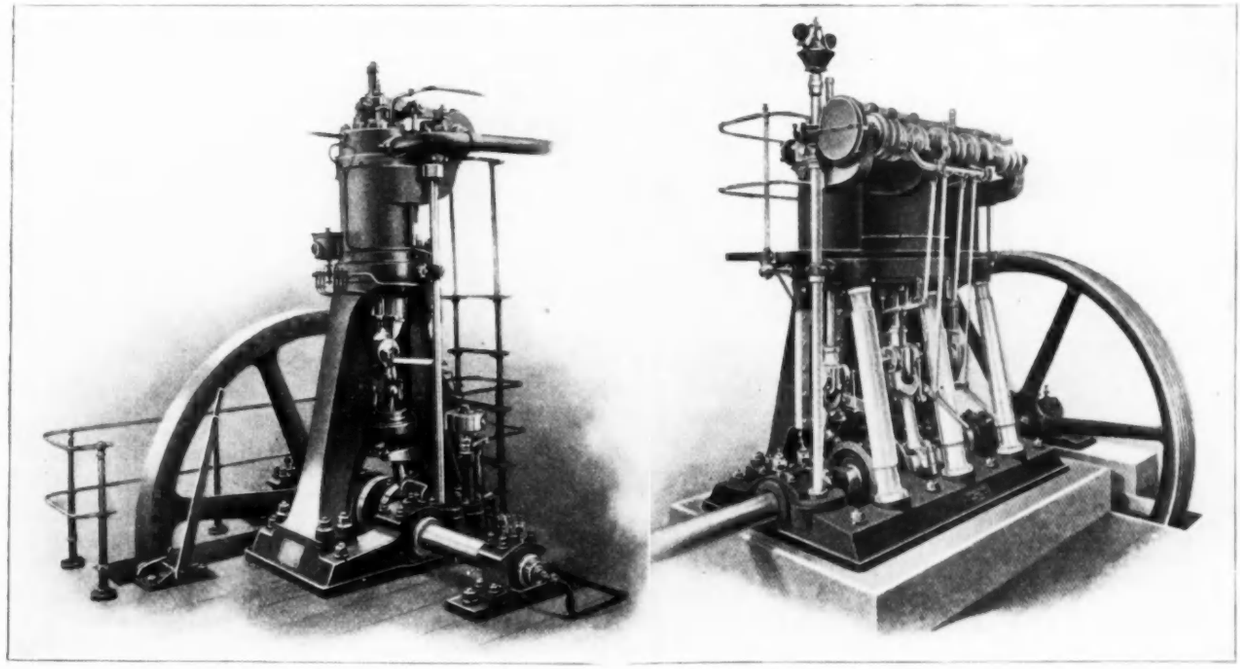


FIG. 4.—20-HORSE-POWER SINGLE CYLINDER DIESEL MOTOR.

FIG. 5.—150-HORSE-POWER COMPOUND DIESEL MOTOR.

movement cylinder *b* draws partly compressed air from tank *i* through valve *j*. During the succeeding return stroke valve *e* is open and *d* and *f* shut, the gases expanding from cylinder *a* to *c*, driving the latter piston downward and compressing a charge of air in tank *i*. The return of *b* further compresses its air, and on the succeeding stroke it acts as a power cylinder, as *a* did on the preceding stroke, and in turn it discharges its exhaust to *c*. The low pressure cylinder will thus be seen to act on every down-stroke, while during its upstroke one or other of the high pressure

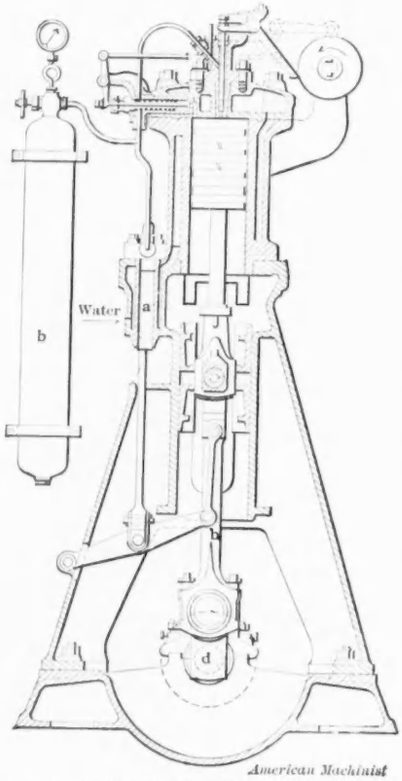


FIG. 6.—SECTION OF SINGLE CYLINDER ENGINE.

cylinders gives out power, the net effect of the three cylinders being the same as that of a single double acting cylinder.

Fig. 4 shows the appearance of a simple engine of 20 horse-power, while Fig. 5 is from a compound engine of 150 horse-power—the largest yet built. In the matter of size it should be said that it is expected to have a machine of 1,000 horse-power at the Paris Exhibition of 1900. Fig. 6 is a sectional view of a single cylinder engine, of which the chief parts remaining to be described are the small air pump *a* and the air tank *b*. The introduction of the fuel against the high pressure at the termination of the working stroke is effected by the small auxiliary pump *a*, which maintains a constant pressure in the tank *b*, about three atmospheres in excess of that in the main cylinder. This air pressure is made to inject the oil into the cylinder. When gas is used for fuel, the auxiliary pump is connected to the gas supply.

The starting of the engine is by the direct use of part of the air or gas in this tank. On shutting down the engine, the charge in this tank is retained, and on starting again the oil, if oil be used, is shut off and the direct pressure from the tank is admitted to the cylinder and drives the engine for a few strokes, when the regular operation is taken up. The starting seems to be a simpler matter than the starting of a steam engine of any considerable size.

Fig. 7 gives indicator cards taken under a varying load, and shows the similarity of the action of the governor to that of a steam engine.

It is claimed that the use of this engine as a marine engine is in sight, and it may not be out of place to glance at the advantages which, granting its practicability for the purpose, it would have over steam engines. Oil fuel is of course more expensive than coal, but this would be largely made up by the greater economy secured. On the other hand the higher calorific value of oil as compared with coal, and the smaller consumption per horse-power by reducing the weight to be carried, would give so much more cargo capacity. The absence of boilers would, too, be of enormous value in this respect. The engine would no doubt weigh more than a steam engine of the same power, though perhaps not much more when the auxiliary apparatus, condensers, evaporators and pumps of all kinds is considered. With these advantages considered, it is clear that the oil fuel might cost materially more in the aggregate, and yet leave a large balance of advantages on the right side.

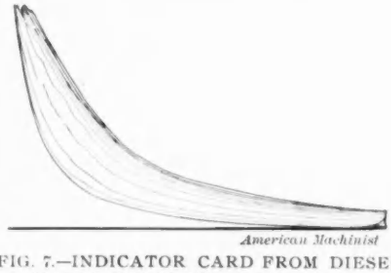


FIG. 7.—INDICATOR CARD FROM DIESEL MOTOR UNDER VARYING LOADS.

The policy of the company controlling the motor is to license builders in all countries.

The engine is controlled in this country by the Diesel Motor Company of America, 11 Broadway, New York.

▲ ▲ ▲

The Institute for Home Study of Engineering and the Correspondence School of Technology, both of which institutions are located in Cleveland, Ohio, have recently been consolidated, and will be known under the name of the Institute for Home Study of Engineering.

Letters from Practical Men.

The Coal Cost of Artificial Ice.

Editor American Machinist:

In the "American Machinist," March 31, I read the following: "In a manufactory of artificial ice 1 ton of coal burned produces 5 tons of ice." There are, without question, back numbers of ice machines that work at the above ratio in operation. The modern ammonia compression ice machine works at the ratio of 7 to 8 tons of ice to the ton of coal burned. This is here in the South, with cooling water 72° Fahr.

FRED KAISER,
Engineer Savannah Brewing Company,
Savannah, Ga.

[If there is anything like as great a difference in refrigerating machine economy as in steam engine practice our figures gave a liberal and complimentary average. We did not offer the statement as representing absolutely the best yet accomplished, and our readers will be glad to receive the above authoritative and up-to-date statement. The most serious mistake in the item is in referring to it as "artificial" ice. Ice machines do not make "artificial" ice, but genuine ice. —ED.]

▲ ▲ ▲

A Vernier Depth Gage.

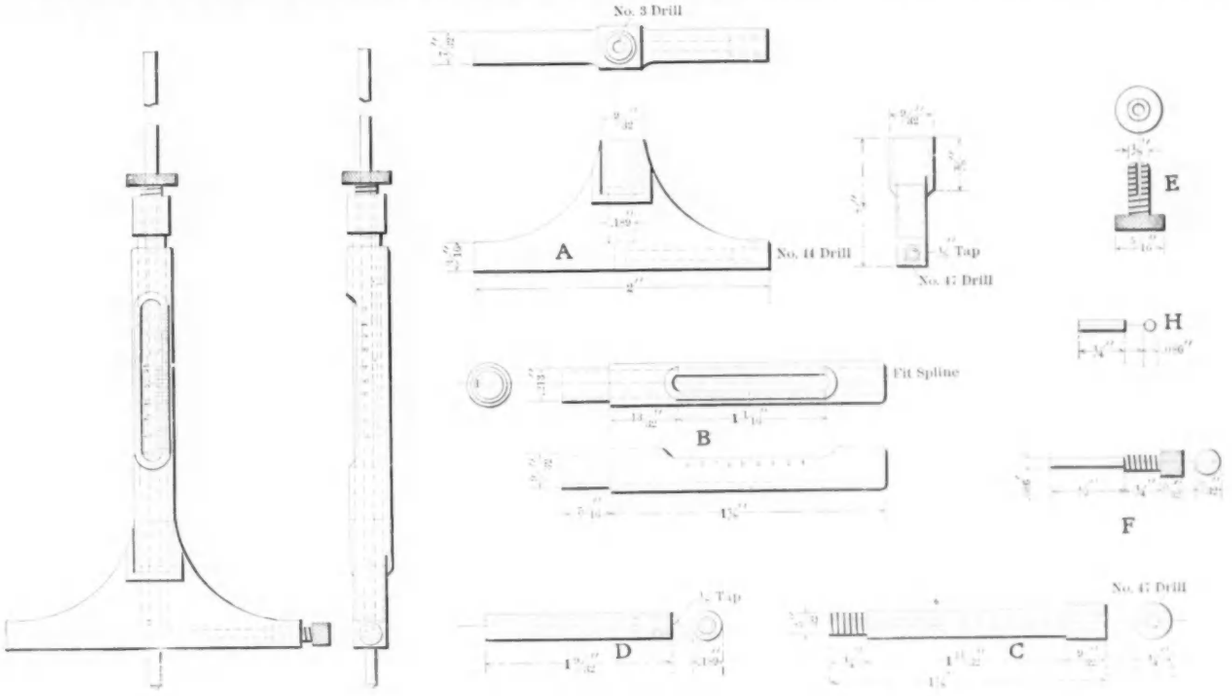
Editor American Machinist:

The drawing shows what I call a vernier depth gage. The idea is to do away with the screw and make it quick in operating. The gage may be used upon any plane surface. The wire is first set flush with the base, and the knurled set screw at the side is tightened to hold it. The split nut on top is then loosened, the inner tube is drawn up to the zero mark and this nut is again tightened. Then, upon loosening the lower screw, the inner tube and the wire may be slipped down, according to the graduations, to the depth required, when the screw may be tightened and the gage is set. Going down to the end of the graduation the depth will of course be 1 inch, and if more than 1 inch is required the wire may be clamped and the inner tube loosened and slipped up to the top for an additional movement. The same operation may be repeated until the required length is secured. The gage is to be graduated the same as the vernier caliper, the outer tube having ten divisions for the inch and these again quartered, making forty divisions. The inner tube and plunger have twenty-five divisions in the space of twenty-four divisions on the outer tube, thus making the reading to thousandths. The drawing

shows all the parts with full dimensions. The instrument is not patented and will not be, but the idea is original with me and it is offered for the benefit of the craft. HERMAN J. HILGENDORF.

Ilion, N. Y.

[The drawings of this interesting little instrument are trusted to explain themselves. We understand that *B* is pressed or fastened into *A*. The feather in the top of *B* being securely fastened in, and *C* being splined to fit it, *D*, when screwed on to *C*, closes the spline and makes it impossible for *C* and *D* to drop out when everything is slackened; but *C* and *D* must evidently be screwed together before *B* is fitted into *A*. The bottom of the hole in *C*, into which the split nut screws, must have a nice taper to compress the end of the nut properly. There is one piece of each, all of steel, except *H*, which would be better of brass.—ED.]



A VERNIER DEPTH GAGE.

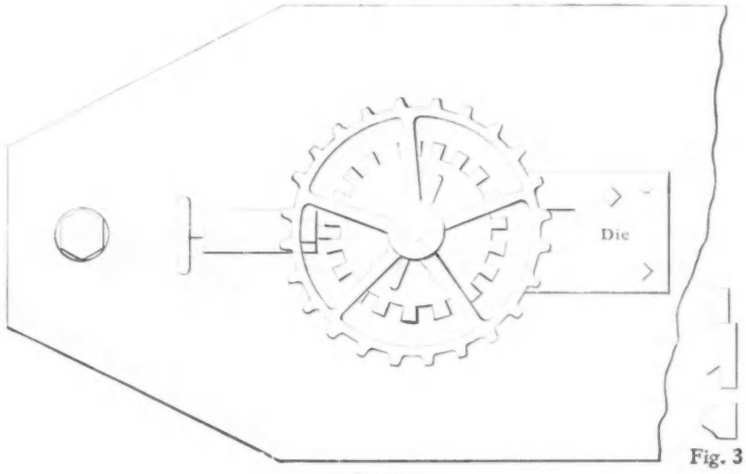


Fig. 1

Fig. 3

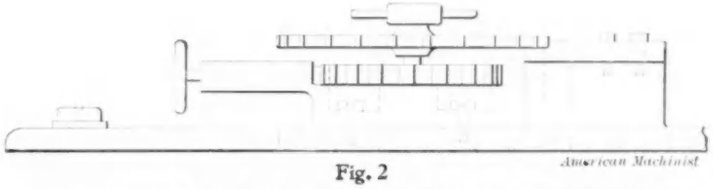


Fig. 2

FIXTURE FOR FINISHING THE TEETH OF SPROCKET WHEELS.

▲ ▲ ▲

Punching Teeth in Sprocket Wheels.

Editor American Machinist:

The accompanying sketch, with a few words of description, will make clear the manner in which we machine our large sprocket wheels.

Fig. 1 shows top view of the device, with sprocket clamped in place.

Fig. 2 shows side view, and arrangement of index plates.

The casting below the index plate is made so that it can be adjusted to and from the die, in order to machine different sized sprocket wheels.

In this same casting an arbor is fastened, so that the index bushing may be revolved. The nut on top clamps the sprocket to the index plate, and a stop against which a certain arm of the sprocket strikes allows the sprocket to be taken out and replaced accurately for the finishing cut.

Fig. 3 shows the punch and the way it is made. The pilot of the punch enters the die before cutting the sprocket.

Two cuts are taken on the sprockets, and by keeping both die and punch sharp good work can be produced. No stripper

is required. With press running at proper speed one tooth can be cut at every revolution.

H. T. GREEN.

Goshen, Ind.

[The temptation to attach to this device an automatic indexing arrangement by which the wheel would be automatically rotated and indexed at each upward stroke of the punch slide must be very strong. It could readily be done and would certainly add to the production and lessen the liability of accidents.—ED.]

▲ ▲ ▲

A Boring Head.

Editor American Machinist:

Railroad shops have a variety of practice in regard to boring car wheels, although the two-cutter type of head is largely in favor on many roads. The Fallbrook Railway shops, however, have always used multiple cutters, for the reason that although somewhat more troublesome to adjust and keep in order the results in smooth and uniform holes have justified the practice.

To simplify and facilitate the adjustment Mr. Foster has designed the head shown in Figs. 1 and 2. This one is made for twelve cutters, *D D*, held by the set screws *E E*. The bar *A* has, as shown, three sizes or steps, and the cutter head is held to it by the key *G*.

By this arrangement different heads are readily used, having different numbers of cutters. When roughing out heavy cuts a head having eight cutters works better than more, as it gives greater clearance space for chips to fall through, and a six-tool head is used when boring car brasses, the machine having suitable chucks for holding this class of work. The twelve-cutter head in wheels having a moderate amount of stock to be removed has a great capacity for rapid and uniform work, and the cutters require a minimum amount of grinding to keep them sharp.

The step marked *A'* is tapped out in the end for the collared screw *C*, which moves the tapered piece *B* up or down, giving a uniform movement to all the tools. If the cutters are to be adjusted to bore a smaller hole, *B* is moved up further than required for the adjustment wanted, and all the cutters are driven in with a copper hammer; then *B* is pulled down until the proper size is obtained.

The cutters are made of Mushet steel, being nicked and broken off the bar by the smith at a low red heat. They are of the shape shown in Fig. 3, the diagonal cut *H* being at the angle required by the tapered piece *B*. The cutters are then ground to the correct bevel, and as the slots are made to accommodate the commercial sizes of this steel very little fitting is required. When a set has been fitted each cutter is marked for its respective slot, then the head with the cutters in place is mounted on centers in a lathe arranged for grinding, and all are ground down to a uniform length and of the size wanted. After being backed off they are ready for use with the assurance that if put in as fitted a uniform cut will be taken by each tool.

Loose wheels of their own assembling are unknown on this road, showing the importance of care in work upon which depends the safety of lives and valuable property.

FRED E. ROGERS.

Corning, N. Y.

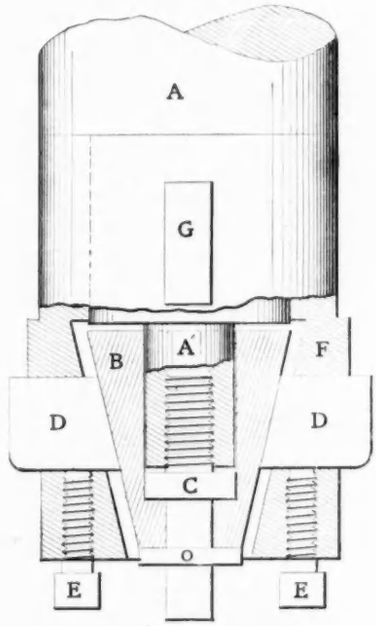


Fig. 1

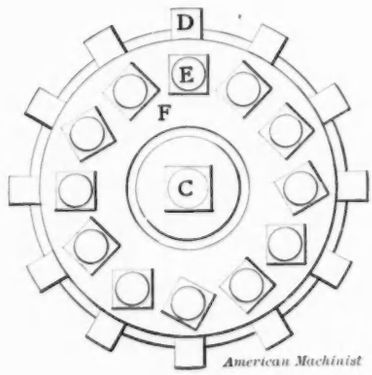


Fig. 2

Fig. 3

A BORING HEAD.

A Molder on Pattern Makers.

Editor American Machinist:

"We don't like pattern makers, for they don't like us." This has been going on for years, but as one cannot get along without the other proprietors should take it up and try to bring us closer together. I am fully aware of the fact that it requires more tools and education to become a pattern maker than a molder, but to be good at either it takes lots of study. I claim that the molder has to do the most thinking. A pattern maker, as a rule, does not visit the foundry unless he is called by the foundry foreman to see why cores do not fit, &c. The great trouble with pattern makers is that they work too close in some things. A core box is made the exact size of core print, a very aggravating thing to the molder. All core prints (except round or standing cores through hubs of wheels, &c.) should be larger than the cores, for a true fin is easier to knock off than one that has been made with a brick. Cone prints, with very few exceptions, are of no use on pattern or core box. Years ago we took all cones off patterns and core boxes; the core is easier made, core box cheaper and the molder does not have to cut clearance around the print so that it won't pull down when he lifts off. He centers from the sides or walls; the cone print does not pull a core straight if it is over 1 inch diameter.

More attention should be paid to draft and not so much to sandpaper and varnish. I think it is robbery to sandpaper, polish and varnish a pattern, spend two or three days on it, give it to the molder about 10 A. M., varnish not dry, must be cast that day, only one off, late heat, cores too big, pattern makers gone home when whistle blows; molder working till 8 P. M., nothing to eat but sour meat and beer, bought at nearest saloon while waiting for metal.

Pattern makers, as a rule, are too slow; they hang over a job until the superintendent gets out of sorts, then a spurt is made and the molder does the rest. It is an old saying that you cannot hurry a machinist or a pattern maker, but the molder is supposed to fly. If he loses a casting it is on account of being thick-headed or dumb; with other trades a miss is called a mistake, or "the draftsman did not show his work right."

MOLDER.

▲ ▲ ▲

Angles of Spiral Gear Teeth.

Editor American Machinist:

Some time ago we required a pair of spiral gear wheels for an oil engine, and not having the rule at hand for laying out the angles for the teeth, I worried out the following plan, which seems to me to be an easy way, at least for the general mechanic.

We will suppose that both wheels are

to have equal diameters, but that one has to make double the number of revolutions of the other:

Draw line *A B*, Fig. 1, equal in length to diameter of one wheel, say the one making the least revolutions. On *A B* erect *B C* at right angles to *A B* and equal in length to other wheel diameter. Join *A C* and divide *A C* into three equal divisions by points *D* and *E*, because the speeds are 2 to 1. Join *E B* when angle *A B E* is the angle for the gear making least number of revolutions, and *E B C* is the angle for the other, the angle being taken from the center line of the shaft in each case, as in Fig. 2.

In practice it would be handier to reverse these angles and use angle *E B C* for the gear making fewest revolutions. The side of the gear could then be used for the base line.

Right here, as so many of your correspondents say, is the one point to be carefully watched, viz., which angle is to be used for each wheel. The one making the least revolutions will, in all practical cases, have the least angle with the center line of its shaft.

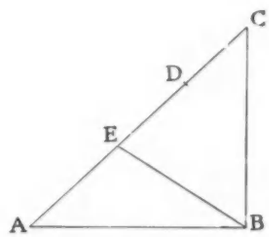


Fig. 1

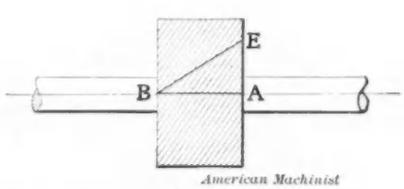


Fig. 2

TO DETERMINE THE ANGLE OF TEETH OF HELICAL GEARS.

I have not had time to go properly into the subject, although I don't see why the rule should not work right when the shafts were at other than right angles.

The above may be quite old to many of your readers, but it was quite new to me. I fancy some may say that they could arrive at the result with half the trouble by using figures, but they are not so obvious to most of us as a drawing, and even then one must find a protractor, which may not be handy.

H. AUSTIN,
Works Manager The Wolseley S. S. Machine Co., Birmingham, England.

Energy Required to Lift the Earth One Foot.

The weight of the earth is undoubtedly pretty accurately known, and knowing its weight it is of course an easy matter to know the number of foot-pounds of work that would be required to lift it any specified distance.

J. A. Renie, in "Power," gives the figures as follows:

"It would require the power of a 10,000 horse-power engine about 70,000,000,000 years to lift the earth one foot in height, and to do this work, allowing 13 pounds of water per hour per horse-power, it would require about 10,000,000,000,000,000,000 gallons of water, or more than would be discharged at the mouth of the Mississippi River in 60,000 years. This would be enough water to cover the entire surface of the earth to a depth of about 300 feet; to convert this water into steam, using good boilers, would require about 4,000,000,000,000,000 tons of coal; if this coal was loaded on care of 20 tons each it would require 200,000,000,000,000 cars; if the cars were 30 feet long and all coupled together in one train it would reach around the earth 45,000,000 times, and if it was running 25 miles per hour it would require 5,000,000 years for it to run the length of itself."

▲ ▲ ▲

Water for Steam Boilers.

Before the Engineers' Club of Philadelphia, on April 2, Dr. Henry Leffmann read a paper on "The Engineering Chemistry of Boiler Waters," in which he gave many interesting facts, especially relating to the waters used in the vicinity of Philadelphia. The two properties of corroding and of scale forming are, to some extent, antagonistic, since the deposit of scale itself protects from corrosion. The purest waters are not always the best for boiler use. The corrosive qualities are due to the water molecule itself, or to the oxygen and carbonic acid present in solution. Organic acids, resulting from the oxidation of vegetable matters, such as are found in waters collected from swampy regions, are corrosive. The same may be said of mine waters, which owe their acidity to sulphuric acid derived from the oxidation of pyrites.

The corrosive action of soluble chlorides on common metal is well known. Sodium chloride and magnesium chloride only come into consideration. The first is present in almost every water, but in surface and unpolluted subsoil water there is very little—less than a grain per gallon. In deep waters it is quite large. In a well on Black's Island, 400 feet deep, just below the mouth of the Schuylkill, the sodium chloride exceeds 50 grains per gallon, and the water would be highly corrosive.

Water drawn from shallow wells in populated districts contains considerable quantities of nitrates, which are corrosive salts. Turbid waters should be filtered before being used in boilers. If alum is used in the filter care must be taken that an excess of alum is not used, as decided corrosion would follow.

The scale forming ingredients of water are principally compounds of calcium and magnesium, usually in the form of sulphates, carbonites and chlorides. The most objectionable is calcium sulphate. It produces a hard scale; the carbonites produce a soft scale.

As engineers must use the water they can get, it is necessary to adopt some method of counteracting their injurious qualities. When corrosion is due to free acid, alkaline substances like caustic soda and soda ash in the water will easily overcome it. In the discussion one of the members stated that at Pottstown, where great trouble was experienced, sal soda had been found a specific.

The prevention of scale is accomplished in various ways, depending upon the character of the substances held in solution. Heating the water before passing it into the boiler will precipitate magnesium and calcium carbonates held in solution by carbonic acid. One of the oldest methods is the addition of slaked lime or caustic soda. It is not easy to precipitate calcium sulphate. The tendency at the present day is to use trisodium phosphate and sodium fluoride.

In the discussion which followed the reading of the paper it was stated by William S. Twining, chief engineer of the Union Traction Company, that in the boiler plants of that company they had found that there was very much less scale formed by the water from the Delaware than from the Schuylkill. The latter water would form a great deal of scale unless counteracted by the use of large quantities of trisodium phosphate. Another member said that a plant in Camden using Delaware water for five years had no trouble from scale and used no preventive. Dr. Leffmann stated that the waters from artesian wells, as a rule, are highly charged with scale-forming elements. Different wells vary in character, although near together. For our abstract we are chiefly indebted to the "Philadelphia Ledger."

▲ ▲ ▲

We have a communication from Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, giving an account of his remarkable success in introducing into foreign countries pneumatic tools made by this company. His success seems to have been all that could be desired, and should be an encouragement for others who may have machines likely to meet with approval in European engineering establishments.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Publishing Co.,

256 Broadway, New York.

JOHN A. HILL, President and Treasurer.

C. A. HANSMANN, Sec'y.

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The Acceleration of Mechanical Progress.

We know beyond question that we do advance continually. We began as hewers of wood and drawers of water, with only our hands and our feet to help us. Then we got horses, and later wind and water to work for us. Only this hundred years have we had steam without limit. A later epoch of advance has begun far within the present generation, in the addition of various power transmitters. Steam has been accessible to practically every machinist of the shop ever since there has been a machine shop. If one of the craft has wanted to blow nicotine out of his pipe, or to dry a towel, or to heat his coffee; if he has wanted a little pressure for any purpose, or if he has had a little engine or some new fangled motor to try, there has always been a steam pipe near at hand, and there has been only the connection to make and the valve to open. The value of steam as a factotum is not to be belittled, but its possibilities have thus far been well exploited, and now we are finding other help with other adaptabilities. As we have so long been able to assume the ever-present steam pipe, we may now generally assume also the electric wire and the compressed air pipe, quite as alive, at the machinist's elbow and ready for employment. The establishments are now quite common where steam, air, water under high pressure and electricity are all at command. Each of these has its special lines of usefulness, and only he who employs them all can enjoy the full available range of modern service. Only he who, as far as may be, understands them all can most profitably employ them, or help to discover, as we have not yet, the greater services of which, individually or in combination, they are capable. While there is an ever-increasing volume of desirable and profitable things to do, and of ways and means for doing them, knowledge is more and more the necessary key to all accomplishments.

▲ ▲ ▲

The old question of navy personnel and the status of engineers in the navy is a live one just now, and it is a question if the efficiency of our naval operations is not to be seriously handicapped by the mistreatment engineers have in the past received. It is understood that the engineers employed on the "St. Paul" and other vessels of the auxiliary navy have received proposals to enlist as engineers in the navy and to remain with the vessels in case the latter are impressed for service.

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It is reported that Chicago retail dealers have inaugurated a novel method of meeting the competition of the department stores, the plan being to organize a co-operative department store to carry on the competition. Just how this co-operative department store can effectively compete with the other department stores without also adding to the competition against the retail stores is what we are unable to understand, and it seems to us that the already established department stores will have the best of the arrangement.

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It seems there are well-defined lines of business in which slow movement of freight is a positive advantage, and this is expected to have an important effect in protecting sailing vessels from annihilation by steam. The movement of wheat is such a case. A year's supply of wheat is brought to market during short periods of time, while the consumption is continuous, requiring great elevator facilities for storage. In such a case the slowness of a sailing ship makes the ship act as a storehouse, and by so much reduces the time the grain is kept in elevators. With equal rates of freight, the sailing ship saves the storage charges for the difference in time between her passage and that of a steamer, and while a ship is, it is true, expensive as compared with an elevator, no ground rent has to be paid at sea.

▲ ▲ ▲

Certain sizes of engine lathes, especially those adapted to making projectiles, are at a premium just now, and the supply is nowhere near equal to the demand. The call for machinery to be used, either directly or indirectly, in carrying on war is very lively, and good machinists are beginning to move from shop to shop under the stimulus of offers of increased wages. It is expected that higher wages for the best men will prevail and that the 1st of May will see a decided advance.

▲ ▲ ▲

There is a new remedy for rheumatism, but it seems to work only on blacksmiths. The remedy consists in the substitution of a pressure blower for a bellows. A testimonial, reading in part as follows, is published in the "Blacksmith and Wheelwright": "I had the rheumatism in my shoulder so bad I could not use a bellows, and my brother bought one of your blowers in the first place, and he had the rheumatism, and he had it not more when he used your blower. So I thought I would use one, and I have not had any rheumatism since I bought the first one, about six years ago, and it is in use now every day."

▲ ▲ ▲

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(41) A. J. P., Philadelphia, asks: Here is a question that I would like to ask: Does a "high-speed" engine derive its name from having a high rotative speed or from having a high piston speed? A.—In the vernacular a high-speed engine means one that has a high rotative speed irrespective of its piston speed.

(42) J. R. P., Stonersville, Pa., asks for the materials used for lining electroplating tanks. Are bare wood tanks practicable? A.—For lye and cyanide solutions bare wood tanks are practicable, yellow pine being the best wood. For acid solutions the wood tanks should be lined with asphalt tempered with resin. The percentage of resin depends on the quality of the asphalt and may be determined by a little experimenting.

(43) W. T., New York, asks: Can you tell me how to make an emery wheel cut freely on the side which is badly glazed over? A stone dresser does not seem to take hold of it. A.—Perhaps it may be necessary to turn off the side of the wheel with a diamond, or it may be that by taking the wheel out, laying it down upon a plain flat surface and picking holes in it with a sharp peening hammer or chisel so that the dresser can take hold of it, will help matters somewhat. Nothing can be certainly told about it, however, without a personal inspection, and if the remedies suggested do no good we would advise corresponding with the makers of the wheel.

Progress at Purdue.

Purdue University has a new building in the process of erection which will constitute an addition to the present Engineering Laboratory. The new portion is 50x100 feet in size, is located between the Steam Engineering and the Locomotive Laboratories, and is to be connected by passageways with both of these. The addition is to be known as the Railway Laboratory, and is the last of the series of engineering laboratories which were provided for in the original plan of the present group. The Purdue Engineering Laboratory now includes seven large laboratory rooms, each presenting an area of floor space of about 5,000 square feet. They are: A wood-working room, foundry, forge room, machine room, Steam Engineering Laboratory, Locomotive Laboratory and Railway Laboratory.

The last named is to be occupied by apparatus for testing the strength of materials and by the brake-shoe testing machine of the American Master Car Builders' Association, which is soon to be deposited at Purdue. It is expected, also, that a considerable amount of other apparatus for engineering research along lines which are of especial interest to car builders and to superintendents of motive power will be given a place in this building.

▲ ▲ ▲

The Exposition in Bergen, Norway.

BY PEDER LOBBEN.

Norway has, in the later years, on account of its improving accommodation for travelers, been growing in favor with tourists who are lovers of strong scenery and beautiful nature. This year it will undoubtedly prove to be an attraction to the American tourist who may visit the land of the midnight sun, to spend a few days at the city of Bergen, and see the industrial and fishery exhibition which will be opened on May 16 and close September 30.

The main building has 12,000 square meters of floor space. Machinery Hall has 2,000 square meters of floor space.

This exhibition will offer a good opportunity for machinery exporters to see and study the resources as well as the wants of that country; at the same time it may be combined into a very pleasant summer vacation trip. The exhibition is not limited to products of Norway and Norwegian manufactures, as space has been secured by exhibitors from not only the different European countries, but also from America and Japan. (All floor space for exhibition was sold long ago.)

As far as possible everything used in the construction and furnishing of the buildings themselves is of Norwegian products and Norwegian manufacture. For instance, the 250 tables in the spacious dining hall are of Norwegian marble. The electric lighting is done by the Electric Bureau in Christiania. Machinists who have not followed the industrial progress of Norway within the last decade will have a pleasant surprise to see the gain made in latter years.

Hotel rates and traveling expenses in general are very moderate in Norway. American travelers will experience very little difficulty with the language, because in the hotels, larger stores and public places in general there are usually one or more waiters who speak the English language as well as the Norwegian. The public roads of Norway are good, and bicycle riders who contemplate a tour to that country will find advantages and pleasure in riding their wheels.

The railroad accommodations, according to American ideas, may not be considered as good as they ought to be; but when we remember that the distances are short and that the accommodations satisfy the public demand, the traveler will only see the difference and not find much ground for complaint. The trains are always (barring possible snow hindrances in the winter) on time, and railroad accidents are an almost unknown occurrence in Norway. Traveling by boat on the numerous lakes is very much enjoyed by foreign pleasure-seekers.

Fitchburg, Mass.

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The Sprague automatic house elevators are being received with a great deal of favor, and many wealthy men of New York city and elsewhere are placing them in their houses. The machine, in its construction, embodies a number of highly ingenious features in its method of control, which is entirely automatic. By means of its devices the machine may be operated from any floor, or from the car itself. By merely pushing a button from any floor the car is brought to that particular floor without further manipulation of the controlling apparatus, and when a door is opened it is impossible to operate the machine from any other point, or until the car has reached its destination and the landing door firmly closed. While the car is in operation it is impossible to operate any of the buttons aside from the one initially connected, and there is also a mechanical locking device at each door preventing its operation except when the car is at corresponding landing.

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Arrangements have been completed by which the next regular meeting of the Western Railway Club of Chicago will be held at Purdue University on Tuesday, April 19. The club will leave over the Monon on a special ahead of the regular morning train out of Chicago, and will give the afternoon to an inspection of the laboratories of Purdue and the shops of the Monon Railway, which are at Lafayette. The University authorities have agreed to make special arrangements by which the scope and character of the engineering work may be seen to best advantage.

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It is reported that a German professor named Nernst has devised a new form of incandescent electric lamp which produces a light of 1.04 candle power for the same consumption of electric energy as the ordinary incandescent light uses to produce a light of .4-candle power. It is reported that the rights have been sold to the Siemens-Halske Company for a very large sum.

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It is announced that the Johnson Steel Company, of Cleveland, Ohio, has been reorganized, and will be known under the name of the Lorain Steel Company, its capital being $14,000,000.

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The Senate Committee on Patents has reported favorably on what is known as the Platt bill, which provides for the reclassification of the records of the Patent Office, and is designed to facilitate examinations and decisions as to anticipatory inventions.

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The West Shore Railroad announces a special rate of a fare and one-third for the round trip for those attending the meeting of the American Society of Mechanical Engineers at Niagara Falls, May 30 to June 3.

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Personals.

Mr. Robert G. Gregory has been made general foreman of the St. Louis Steam Engine Company, St. Louis, Mo.

Passed Assistant Engineer A. Moritz, U. S. N., has been detached from the "Minneapolis" and ordered to the "Saturn."

We welcome personal items regarding men connected with the machinery business. Kindly contribute what you can to this department.

Mr. Joseph Boyer, inventor of the Boyer pneumatic hammer and piston air drill, has gone to Europe for the purpose of making a tour of the Continent in the interest of the Chicago Pneumatic Tool Company.

Mr. W. D. Woolson, treasurer of the Jones & Lamson Company, has returned from a six weeks' trip to England and Germany "in the interest of the health of the J. & L. order book."

Mr. Charles A. Boyd, superintendent of the Walker Company, of Cleveland, has resigned his position, to take effect April 12. He will enter business for himself, doing general engineering, with offices in the American Trust Building, Cleveland, Ohio. Mr. Boyd has been with the Walker Company for the past four years, starting as engineer in the railway motor department, having charge

of the design and construction. About one year later he was placed in charge of the entire engineering department, and was promoted to the position of assistant superintendent on January 1, 1897. The following March he was appointed superintendent of the Cleveland works, having in charge both the engineering department and shops.

Mr. Christ. Wais, president of the Wais & Roos Punch & Shear Company, of Cincinnati, Ohio, recently sailed for Europe in the interest of the above firm with the intention of visiting both England and Continental Europe, expecting to be away at least two months.

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Obituary.

Peter Hoffman, a retired machine shop proprietor, died in Jersey City, N. J., on April 7. He was born in Alsace-Lorraine in 1830, his parents coming to this country two years later. Mr. Hoffman established the Fulton Iron Works, Jersey City, in 1855 and retired from business about ten years ago.

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Inquiries for Machinery.

Those who make, or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

50—Machinery for the production of flaked cereals, such as flaked oats, corn, etc.

51—From South Africa, for machinery suitable for bone crushing.

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Commercial Review.

NEW YORK, Saturday Evening, April 9, 1898.

THE ENGINE MARKET.

It is hardly to be expected that while the war-at-any-price spirit is so rampant as it has been for several weeks past we can report that the mails are over-crowded with orders for engines and boilers any more than for other classes of machinery not peculiarly applicable to military work. It is an occasion for congratulation, however, that the market holds its own tolerably well. Several companies have lately received a better number of orders than usual, and of a healthy, industrial character at that; but in general we are constrained to believe that the engine and boiler trade is not now as active as it was toward the end of 1897, and that this spring is not fulfilling the anticipations then entertained for it. Setting aside, if we may, such a prodigious factor as the war eventualities, the outlook is far from unfavorable, for the inquiry for future work is even now comparatively good.

The tendency of the war—whether in prospect or in fruition—to retard the closing of large contracts will probably be exerted more powerfully along the seaboard than in the interior of the country; for to the liability to indirect loss of investments through industrial stagnation will be added the danger of direct destruction of property by an invasion or a bombardment. We are informed also of some hesitancy in the consummation of business with South America, owing to the fact that the route of transportation to many of its points lies through the threatened storm center. It does seem that hostilities, if they occur, will more severely handicap our coasting trade than our trans-Atlantic commerce, because the former is largely done upon American bottoms, while in the latter only one steamship line of any importance has American registry.

There is little business now coming to the engine builders from local office buildings, nor is there much of it in immediate prospect.

SOME FAVORABLE REPORTS.

We are glad to note that in spite of the disturbed situation an old and highly respected boiler company in this city reports a notable increase of orders. Of some ten that have come in very lately about all are for domestic purposes; electric railway work and paper manufacture being the lines of industry most notably represented among the purchasers. We cannot refrain from raising the query whether the paper mill orders are not to be considered of a military character, and whether they are not to be deplored, as likely to increase our already too heavy burden of war extras of the yellow journals.

The Ames Engine Company, notwithstanding the unfavorable influences of the times, has lately made better sales of engines than for some time in the past. Two of these are bound for Singapore to run the Walker lighting generators referred to in the last number of our paper. In this country sales of several engines for local instalment are mentioned, and two for Worcester, Mass.

An official of a well-known pump company tells us that its business continues excellent and is improving despite the war agitation. The average of the first three months of this year is remarkably in excess of the average last year taken as a whole. This is the season for waterworks contracts, and the company referred to is receiving many of them.

One engine and boiler seller has, in the past ten days, received five new inquiries from within 12 miles of New York city, which is better than hitherto. Four of these inquiries were from dry goods establishments.

DO LOW PRICES PAY?

The manager of the New York office of an old and well-known engine company, which has of late years sold but few engines in this territory, remarks as follows: "We have made practically no change in the prices of our engines for five or six years and I am not sure but it would have been better policy to have lowered them. Old conservative companies such as ourselves naturally have less modern appliances than the newer ones, which are making low figures and which have secured the orders and been able to execute them, notwithstanding cheapness, at a profit to themselves. If we had made a cut of 5 or 25 per cent. doubtless we should have received all the contracts we could fill, we might have put in new machinery and have come out better in the end than we have done. The methods of conducting the engine business are such that the prices are not, as a general thing, known to the public. Also, sellers depend chiefly upon new customers and former buyers cut a relatively insignificant figure. Therefore the fact of having made concessions in order to secure business does not so irretrievably commit one to these low figures for the future in the case of engines, as in other lines of trade; for the new customer does not know what has been charged in other cases."

In quoting the above we are not arguing for lower prices than have already been made. It must be borne in mind that the company of the speaker has not already made the cut rates that others have. What we need to see throughout the market is rather a stiffening of prices than a weakening.

COMMERCIAL REASONS FOR A CHANGE OF NAME.

In the last issue of our paper was contained a notice of the fact that the Davis & Egan Machine Tool Company, Cincin-

Continued on page 37.

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Business Specials.

Gear wheels, gear cutting. Grant; see page 18.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Iron foundry foreman wishes position; machinery, heavy and light; first-class ref. Box 191, AM. MACH.

A first-class patternmaker and draftsman desires a a sit. as a draftsman; A1 references. Box 201, AM. MACH.

Foremanship, general jobbing and repairs; twenty years' exp., eight years foreman. Box 204, AM. MACH.

A blacksmith would like employment in a mach. or R. R. shop; has had a consid'ble exp. Box 200, AM. MACH.

Position as draftsman, well up in spec. auto. mach'y; tech. grad.; good shop experience. Box 203, AM. MACH.

A shop superintendent of one of the most successful turret lathe builders desires a change; nine years in present position; best ref. Box 174, AM. MACHINIST.

Tool maker of fifteen years' experience; graduate of a leading business college, seeks a position as supt. of manufac. concern; A No. 1 ref. Box 194, AM. MACH.

Wanted—Situation as supt. or mgr. mach. works, by mech. engineer; 15 years' exp. on high speed Corliss and marine engs., pumps and general mach'y; up to date on both bus. and mech. methods. Box 179, AM. MACH.

Situations Wanted—Cont'd.

Foundry foreman, American, age thirty-eight, desires to make a change; up to date in modern foundry practice and the economic production of good work. Write for particulars, Box 199, AMERICAN MACHINIST.

Mechanical engineer, now holding position as traveling salesman with the largest machine tool works in the country, desires to make a change, and will accept similar pos. elsewhere; ref. A1. Box 196, AM. MACH.

Wanted—Position in charge of shop as foreman or supt.; experienced on light and heavy work; best reference; if not satisfied with cost of manufacturing, write to Box 197, AMERICAN MACHINIST.

A mech. eng., who has been accustomed to handling men, both in drafting room and shop, is open to offers; has held positions with Brown & Sharpe Mfg. Co., Pond Machine Tool Co., the United States Government, Brown Hoist'g & Convey'g Mach. Co. Box 207, AM. MACH.

Help Wanted.

Wanted—Draftsman on engines and boilers. Address, with full particulars, Ohio, AMERICAN MACHINIST.

Wanted—Two practical draftsmen on engine work; steady employment to right men. Box 185, AM. MACH.

Wanted—Foreman for tool room, accustomed to light work; give reference and state wages expected. Address Box 206, AMERICAN MACHINIST.

Wanted—A capable draftsman, with some experience in designing machine tools; state salary expected and qualifications. Box 182, AMERICAN MACHINIST.

Wanted—Traveling representative for small manufactory of automatic engines and power transmission mach'y.; one who is a pracl. draftsman pr'f'd. Address, stating age, ref. and sal. exp'd, Box 202, care AM. MACH.

Wanted—A thoroughly competent party to manage mechanical department of modern mining and milling; technical man preferred; state age, exp., reference and salary; location good. Address Box 184, AM. MACHINIST.

Wanted—By Western manufacturer experienced smith shop foreman, familiar with oil furnaces and light and heavy forging, suitable for pumping engine and mining work; write, stating age, exp., and wages; ref. required. Address Box 198, AM. MACH.

Wanted—Shortly by a firm intending to build a factory in Scotland to manufacture special tools, a first-class machinist; machinist experienced in shop management and a good machine designer; a good salary and a fair share of profits; state qualifications and give references from good firms to James McKenzie, 150 St. Vincent street, Glasgow, Scotland.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

For Sale—Kit of pattern makers' tools, little used. Box 205, AMERICAN MACHINIST.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Emery Wheel Dressers; send for sample and price. Manufactured by Geo. H. Calder, Lancaster, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Machinery dealers wanted as agents in New York Boston and Philadelphia to handle our automatic engines, etc. Clark Bros., Belmont, N. Y

Advertising Novelties Wanted—We will buy patents, manufacture for patentee or on a royalty, good advertising novelties Address P. O. Box 125, Erie, Pa.

Wanted a purchaser for a valuable patent on drilling machine, illustrated and described in the AM. MACH. May 13, 1897. Wm W. Flickinger, Cochranton, Pa.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

If you use Brass, Bronze or Composition Castings write to us for prices; satisfaction guaranteed on all orders undertaken. James J. McKenna & Bro., 424 & 426 East Twenty-third St., New York. Established 1833.

The advertising department of the American Machinist has on hand 20,000 drafsman's thumb tacks; will send a box of ten to any draftsman in America on request; could use a postage stamp on box, but will send the tacks anyway.

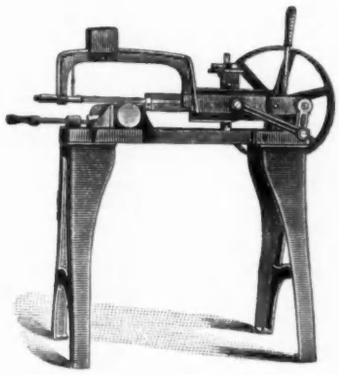
Mech. eng., 17 years' exp. as mach., draftsman, supt., and manager, A1 bus. and mech. ability, desires association with mod. mach. works, to build line of mach'y already introduced and on market; $20,000 of orders on hand; chance for concern with plant to secure paying bus. Address, with full particulars, Box 180, AM. MACH.

"The best is as good as any."

The New

Automatic and Gravity **Feed**

Q & C Shop Saw

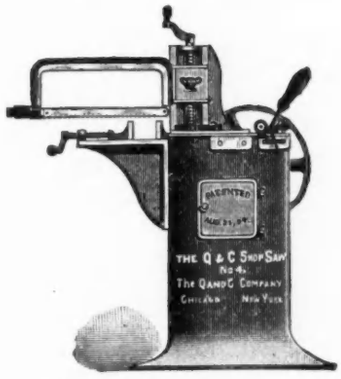


Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.
Quality—'Way Up.

Shop Saws,
Portable Rail Saws,
Cold Power Saws,

For All Purposes.



Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.

Continued from page 36.

nati, was hereafter to be known as the American Tool Works Company. This change of designation was made with reference to the exigencies of foreign trade. In the words of Mr. Charles Davis, the president of the old concern, and who will, it is said, be president of the new one: "The great demand and acknowledged superiority of American-made machinery in Europe has induced the change in name."

In relation to American machine tools the word "American" occupies a prominent place in the European mind, and since, in that connection, if in no other, it enjoys high popularity, the individual company which can avail itself of the generic term will receive a consideration that it might fail of obtaining were it known by a title less suggestive to a foreigner of its national character.

The change of name above alluded to took place during a reorganization of the company, at which time the capital stock was increased from $500,000 to $1,000,000. The last act of the directors of the old company was to declare their customary quarterly dividend of 3 per cent. The European business of the company has been built up within the last two years, and amounted in 1897 to over $500,000. On Monday of this week were received orders from Europe aggregating 83 tools, The concern is now sold out three months or more in advance. In its new auxiliary shops at Covington, Ky., operations are just being commenced. In this plant the heavier machinery will be constructed. Mr. Davis will soon start again for Europe to spend the coming summer.

ELECTRICAL NOTES.

The Westinghouse Electric & Manufacturing Company is about to ship $682,000 worth of electrical material to the Brooklyn Navy Yard for the installation of electric lighting and power plants on the old monitors, coasting steamers, etc., now being fitted up for war. There is a bonus of $25,000 for prompt delivery.

The C & C Electric Company tells us that its orders from England have lately been particularly good, and have included a number of dynamos and motors for the Brighton School of Technology. Among other foreign work has been a mining hoist for New Zealand, and in this country orders for twenty-five motors for coal cutters to be built in Pittsburg, besides three large generators and fifteen motors for a large manufacturing plant in Brooklyn. It is a motor of this make that is in use in the torpedo boat of Lieutenant Halpine, controlled from the shore, which is now being experimented with.

A New York syndicate proposes to found 122 new industrial establishments in Mexico, the majority of them to be electrically driven. It has purchased a concession obtained by a Mexican syn-

dicate to develop fifty-six waterfalls with an aggregate power of 1,331,325 horse-power.

A syndicate has proposed to install an electrical towage system on the canals and navigable rivers of Holland, Belgium and eastern France, and has laid the proposition before the governments of those countries.

A large electric light plant is to be erected at Punta Arenas, Chili, and to be equipped with Westinghouse engines and dynamos.

Inquiries have come to this market for electric elevators to go to Argentine Republic.

A company has been formed in London to light electrically Santiago, Chili, and another company has been formed to light Valparaiso.

For an electric railway at Manaos, State of Amazonas, Brazil, have been purchased three 250 horse-power, tandem compound, direct connected, high speed, Payne engines.

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Quotations.

NEW YORK, Monday, April 11.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 00 @ 11 50
No. 2 foundry, Northern	10 50 @ 11 00
No. 2 plain, Northern	10 00 @ 10 50
Gray forge, Northern	10 00 @ 10 50
No. 1 foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 25 @ 10 50
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, Southern	9 75 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock. Common, 1.07½ @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in retail lots, 2.15 @ 2.25c.

Copper—Carload lots: Lake Superior Ingot, 12⅛ @ 12¼c.; electrolytic, 11⅞c.; casting copper, 11⅝c.

Pig Lead—Carload lots, 3.65 @ 3.67½c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 14.60c., f. o. b.

Spelter—Carload lots, 4.30c., New York delivery.

Antimony—Cookson's, 8 @ 8¼c.; Hallett's, 7¾c.

Lard Oil—Prime city, present make, 45 @ 46c., in wholesale lots for a good brand, with possibly slight concessions on some.

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Manufacturers.

Janesville Machine Company, of Janesville, Wis., has been incorporated.

An addition is to be made to the Brown Cotton Gin Company, New London, Conn.

It is rumored that the Peru (Ind.) Bagging Company may locate a plant at New Albany, Ind.

The plant of George Arnty & Sons, Decatur, Tenn., which was recently burned is to be rebuilt.

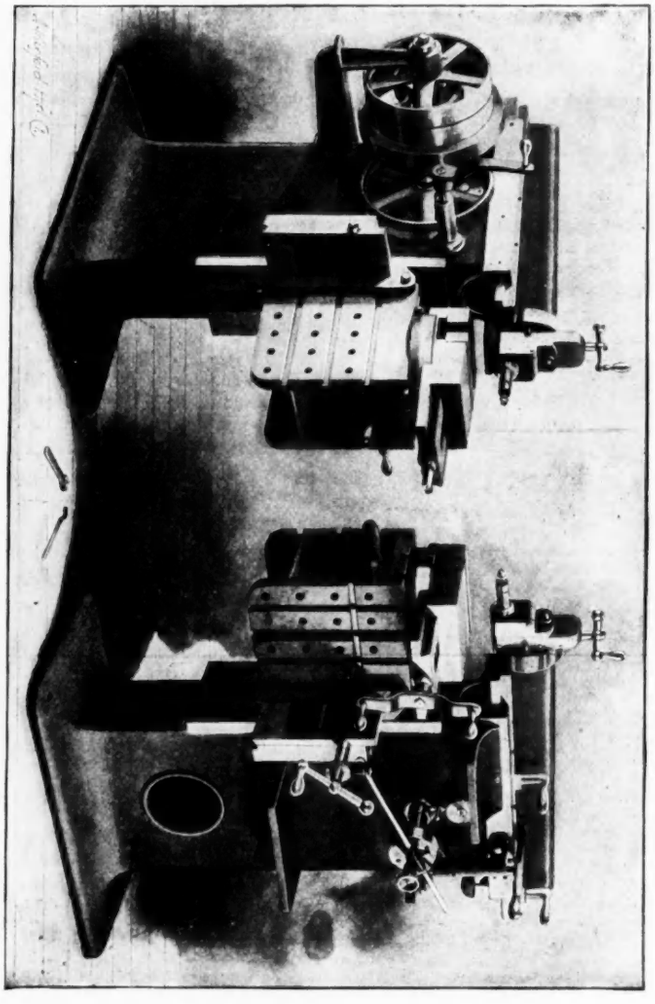
The Keystone Typewriter Company contemplates the erection of a new plant at Harrisburg, Pa.

Ground has been broken for an addition 80x150 feet to the Molin Malleable Iron Works at St. Charles, Ill.

The site for a new industrial enterprise for Lyons, N. Y., has been purchased by Messrs. E. F. Berns, August Schlee and Theodore Schlee, who have formed a co-partnership for

15-inch Pillar Shaper.

A FRICTION driven machine, fitted with a positive locking device for friction, insuring a uniform length of stroke under a heavy cut. Stroke can be changed to any position with ram in motion; has quick return; and our micrometer adjustment makes possible the most minute variation in length of stroke, which can be constantly varied with machine in motion; an especially valuable feature in tool and die work and in planing to irregular lines.



THE HENDEY MACHINE CO.,

Torrington, Conn.

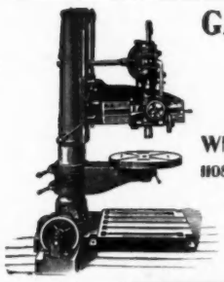
AGENTS FOR THE PACIFIC COAST:

PACIFIC TOOL AND SUPPLY CO., . . . San Francisco, Cal.
J. W. CREGAR, ... Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:

SCHUCHARDT & SCHUTTE, . Berlin, Vienna, Brussels, Stockholm.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.
ADOLPHE JANSSENS, ... Paris, France.

Turret Drills
with from 4 to 12 Spindles.
Milling Machines
with 4 Spindles.
Manufactured by
A. D. QUINT,
3 CLINTON ST., HARTFORD, CONN.



GANG'S RADIAL DRILLS.
WM. E. GANG & CO.,
1108 Harrison Ave.,
CINCINNATI, OHIO, U. S. A.
See last week's issue

R. POOLE & SON CO.
ENGINEERS, FOUNDERS AND MACHINISTS,
BALTIMORE, MD.
MANUFACTURERS AND DESIGNERS OF ALL KINDS OF
HEAVY MACHINERY,
REQUIRING FIRST CLASS WORKMANSHIP AND MATERIALS.
BAND, ROPE AND FLY WHEELS. FRICTION CLUTCHES. PULLEYS, SHAFTING AND HANGERS.
MACHINE MOLDED AND PLANED GEARING.
POOLE-LEFFEL TURBINE WATER-WHEELS.
CIRCULARS ON APPLICATION.

For Advertisement of
TIGHT JOINT CO., New York.
See Issue April 7, 1898.

Fay & Scott, Dexter, Maine,
Pattern Makers' Lathes are good tools, and are to be found in good shops.

Mark Your Tools With a Steel Stamp.

SEND FOR PRICE LIST No. 4.

.. THE ..
Essentials of Gearing.
By GARDNER C. ANTHONY.

A practical treatise for self-instruction and class room use. It contains well chosen problems, designed for a progressive course of instruction. There are numerous cuts, fifteen full page drawings, a comprehensive index and practical formulas.
Cloth. 6x7½ inches. Price **$1.50**, post paid.

D. C. HEATH & CO., Publishers,
Boston, New York, Chicago.

ACTIVE, RELIABLE FIRM in GERMANY, highly reputed, whose Principal is about to visit the U. S., wishes to enter into **BUSINESS RELATIONS with INVENTORS or MANUFACTURERS of MODERN METAL-WORKING and SPECIAL MACHINERY.** New labor-saving working methods, or new articles of real merit.

Exploitation for joint or own account or representation. **FIRST-CLASS EUROPEAN CONNECTIONS,** wide experience. Great success with sale of patents can be proved. Highest references given and requested. Address "Be Quick," Office of the AMERICAN MACHINIST.

MACHINISTS AND ENGINEERS!
RECEIVE INSTRUCTION BY MAIL.
Mechanical Drawing and Machine Design.
Electrical and Mechanical Engineering.
Write for free circular T.
The United Correspondence Schools,
F. W. Ewald, Gen. Mgr., 154-156 Fifth Ave., New York.

GRINDSTONES
for finishing castings, tool sharpening, etc. Let us select a grit exactly suited to your work.
The Cleveland Stone Co.,
Euclid Avenue, Cleveland, Ohio.

PRESSES (FOOT AND POWER),
DIES AND OTHER TOOLS FOR SHEET METAL WORK.
NEW STYLES, IMPROVED DESIGN AND CONSTRUCTION.
SEND FOR CATALOG.
FERRACUTE MACHINE CO., Bridgeton, N. J., U. S. A.

Use ◆ **Diamond Brand**
Hardening Compound.
SAVES TIME, LABOR AND MONEY.
The Metal Specialty Co., 4 Gold St., NEW YORK.

NEW HAVEN MFG. CO.
NEW HAVEN, CONN.

Manufacturers of
IRON WORKING MACHINERY,
Planers, Lathes, Slotters, etc.

the purpose of operating a foundry and general machine shop.

H. A. Romberger is preparing the plans for a new mill at Middletown, Pa., and will buy new knitting machinery.

At Kansas City, Kan., the McKenna Rolling Mills Company is to erect and equip a new rolling mill and foundry.

Messrs. Rhodes, Curry & Co., of Amherst, N. S., whose works were somewhat damaged by fire, are to rebuild them.

The Geiser Manufacturing Company, Waynesboro, Pa., will expend $50,000 the coming summer to improve its works.

The Bryce Company, Mount Pleasant, Pa., will soon begin the erection of a brick addition, 12x60 feet, to their glass plant.

The Clinton Blast Furnace Company, on West Carson street, Pittsburg, Pa., is going to build a cement works adjoining its furnace.

C. W. Rich, Crestville, Tenn., will install machinery, including engines, boilers, stave machines, dry kilns, shafting, belting, etc.

The Union Carbide Company of Richmond, Va., has recently been incorporated, and will engage in the manufacture of acetylene gas.

The brick work of the new addition which the Sargeant Manufacturing Company, Muskegon, Mich., is erecting to the factory is near completion.

The Lehigh Company will shortly enlarge the yard and shops at Packerton, Pa., and erect a new car wheel shop. The new structure will be 40x80 feet.

The Torkelson Manufacturing Company is about to be organized at Warren, Mass. It will engage in the manufacture of guns. The capital stock is $12,000.

The American Road Machine Company will erect a brick building, 50x100 feet, and two stories high, on South Broad street, Kennett square, Philadelphia, Pa.

William Musey and E. B. Izer, of Hagerstown, have been awarded the contract to build a large addition to the Geiser Machine Works, at Waynesboro, Pa.

Plans are being made by Architect W. S. Knapp for an addition to the factory of the Norwalk (Conn.) Iron Works. It will be of brick, 35x70 feet, one story high.

The Columbia Heater Manufacturing Company, of Minneapolis, Minn., has been incorporated by Peter Monson, Geo. V. Smith, Chas. E. Veeder and E. H. Mathis.

The Jacob Dold Packing Company, Wichita, Kan., will commence in the next ten days to make some radical improvements. There will be five new buildings erected.

The business of the Chicago Pneumatic Tool Company has grown to such an extent that it contemplates the establishment of a factory in Europe to supply the demand there.

The Du Bois (Pa.) Iron Works is to have a large addition erected. This addition will be 80x220 feet. The demand for more space has been occasioned by increased orders.

The Springfield Drop Forging Company, of which H. W. Goddard is president, has decided to greatly increase its works at Brightwood, Mass., and will erect a new building.

The Canton (Ohio) Rolling Mill will double its capacity at once. The buildings will be enlarged to twice their present size, and more men will be added to the concern's payroll.

The plant of the Pittsburg Waste Company, on Thomas street, near Trenton avenue, Wilkinsburg, was recently destroyed by fire. The company will rebuild the plant at once.

We beg to state that the item published in a recent issue to the effect that the Sloss Iron & Steel Company would construct a bi-product saving plant at Birmingham, Ala., is incorrect.

The Le Fevre Manufacturing Company, of Jersey City, N. J., has been incorporated to manufacture bicycle sundries. Capital, $150,000. Corporators—Nevin B. Le Fevre, of New York;

George W. Hemperly, of Harrisburg, Pa., and Joseph H. Buckridge, of Jersey City.

The Philadelphia & Reading Railroad Company has about completed plans for a number of improvements at Tamaqua, Pa. Among these will be a new and more modern machine shop.

The Silver Brothers Iron Works Company has been incorporated at Salt Lake City, Utah. John A. Silver is president, Hyrum A. Silver vice-president, and Joseph A. Silver, secretary.

A foundry company, with a capital of $15,000, has been formed at Greensburg, Pa., composed of Col. L. B. Huff, Richard Coulter, Jr., J. Howard Patton, Harry Burkem and J. R. Eisaman.

F. W. Dean & Son, Glastonbury, Conn., will soon begin work on a 25-foot extension to the factory of the Riverside Paper Company, formerly occupied by the Eagle Sterling Company.

Sible Prescott, president of the Marinette Iron Works, says that the $300,000 plant of the company which is being operated in Duluth, Minn., will be removed to Marinette, Wis., within a short time.

The Gisholt Machinery Company, of Madison, Wis., is reported to be busy on an order for machine tools to be used in the manufacture of projectiles for heavy guns. The work is being pushed night and day.

The Duryea Motor Vehicle Company, of Jersey City, N. J., has been incorporated. Capital, $1,500,000. Corporators—William P. Williams and Charles L. Spencer of New York, and Charles H. Hall, of Jersey City.

Articles of incorporation of the Laramie (Wyo.) Iron & Steel Company have been filed. The capital stock is given as $10,000, with the following officers: Otto Gramm, president; C. W. Burdict, vice-president.

The Iroquois Iron Works, Buffalo, N. Y., has been incorporated. Capital, $100,000. Office, Buffalo. Directors—Stephen M. Clement, Sheldon T. Viele, Robert R. Hefford, William V. Warren, W. Grant King, all of Buffalo.

Henry Schlacks has planned an addition for the factory of N. W. Eisendrath & Co., 1 and 3 George street, Chicago, at a cost of $18,000. The addition will be 146x89 feet in size, two stories high, and will be constructed of brick.

John B. Snook & Sons, of No. 261 Broadway, N. Y., are preparing plans for the one story brick extension to the power house at Unionport, Westchester County, to cost about $5,000, for the Bronx Gas & Electric Light Company.

The Shelby (Ohio) Electric Company stockholders held a meeting recently, and decided to increase the capital stock of the plant from $100,000 to $250,000. The factory will be doubled, and the work of construction is to begin at once.

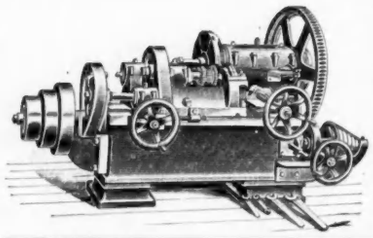
It is reported that at Springfield, Ohio, the Whitely Manufacturing Company, with George S. Graham, of Philadelphia, president and treasurer W. T. Stillwell, of Baltimore, has been organized to engage in the manufacture of cellulose.

A charter has been issued to the East End Manufacturing Company, of Pittsburg, Pa., to manufacture wrapping machines. Capital, $25,000. Directors—J. H. Fehnlee, Prestley P. Murphy, Joseph K. Paull, Edward Watson, J. F. Nulton, Pittsburg.

The Bullock Electrical Manufacturing Company, Cincinnati, Ohio, will soon commence the erection of the new buildings on the property purchased by them in Norwood. The buildings will cost upward of $150,000, and all machines will be run by electric motors.

Electrical apparatus authorities at Warsaw, Russia, are inviting proposals for supplying the town with electrical power for purposes of lighting, tramways, etc. Applications should be addressed to the president of the town of Warsaw, from whom particulars can be obtained. As the proposals will not be considered until some time

CIRCULAR MILLING MACHINES



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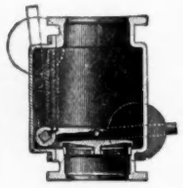

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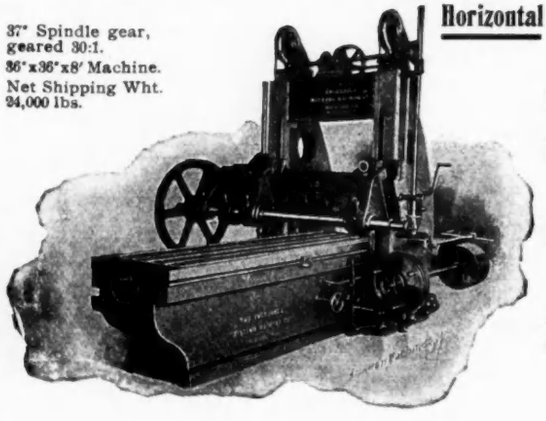

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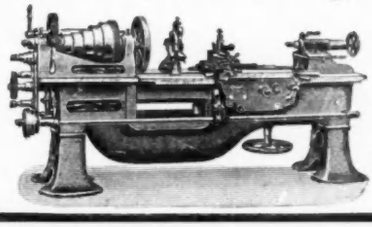

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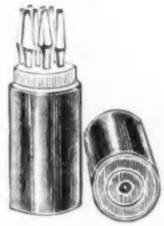

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in August next, there is ample time for the American manufacturers and contractors to submit their prices after the rules, regulations and conditions have been sent to them.

The Smyth Machine Company has incorporated to do business in Los Angeles, Cal. Capital stock, $300,000. Directors—J. E. Smyth, H. M. Dobbins and David M. Smyth, of Pasadena; Mrs. Caroline W. Dobbins, of South Pasadena, and Thaddeus Lowe, of Los Angeles.

Ground has been broken for two large additions to Wilmot & Hobbs' plant, Bridgeport, Conn. They will be three stories in hight. One will be 133 feet by 76 feet and the other 90 feet by 60 feet. The work will be done by Dowling & Bottomly, and will be under the supervision of G. W. Longstaff.

Lancaster, Pa., is to have another new factory, a charter having just been secured by the Lancaster Sheet Metal Company, with a capital of $25,000. The officers are: President, H. L. Raub; secretary, A. K. Raub; treasurer, R. M. Reilly. A factory will be erected at once at the corner of Christian and Marion streets.

One of the latest contracts awarded the Sprague Company is that awarded by the John Stephenson Car Company, of Elizabethport, N. J. Each of the Stephenson machines will have its independent Lundell motor, and the sizes used will be from 3 to 40 horse power, most large size machines. Some of them will be direct-connected and some geared. In addition to the power motors the Sprague Company has secured a contract for exhaust fan outfits. The plant will be one of the largest of its kind in the country, and will employ only Lundell motors.

▲ ▲ ▲

New Catalogs.

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Goodell Brothers Company, of Greenfield, Mass., have sent us catalog No. 3 of machinists' tools, including drills, drill chucks, bench drills, etc. The catalog is standard size, 6x9 inches.

We have received from the Carborundum Company, Niagara Falls, N. Y., a small catalog containing a number of testimonials from parties who have used and are using carborundum. The catalog is 4x6 inches.

We have received from J. M. Carpenter Tap & Die Company, Pawtucket, R. I., catalog No. 12 of taps, screw plates, dies and other screw cutting appliances. The catalog is standard size, 3½x6 inches.

We have received from the Globe Iron Works, Minneapolis, Minn., catalog of the White gas engine. The engines are made to be used in marine as well as land service. The catalog is standard size, 6x9 inches.

The Remington-Sholes Company, of Chicago, has issued a new catalog in which is illustrated and described the Rem-Sho typewriter. The various parts of the machine are minutely described. The catalog is 6½x7¾ inches.

We have received from the Diesel Motor Company of America, 11 Broadway, New York, catalog of the Diesel motor, which catalog is accompanied by a "History and Development of the Diesel Motor." Both are standard size, 6x9 inches.

The Blanton Patents Syndicate, Ltd., London, England, which has an office in Bourse Building, Philadelphia, has sent us catalog of the Blanton patent fastenings used in keying wheels and pulleys on shafts. The catalog is standard size, 6x9 inches.

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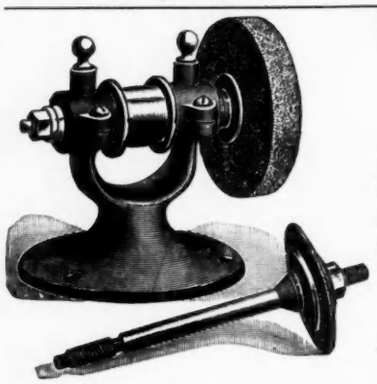

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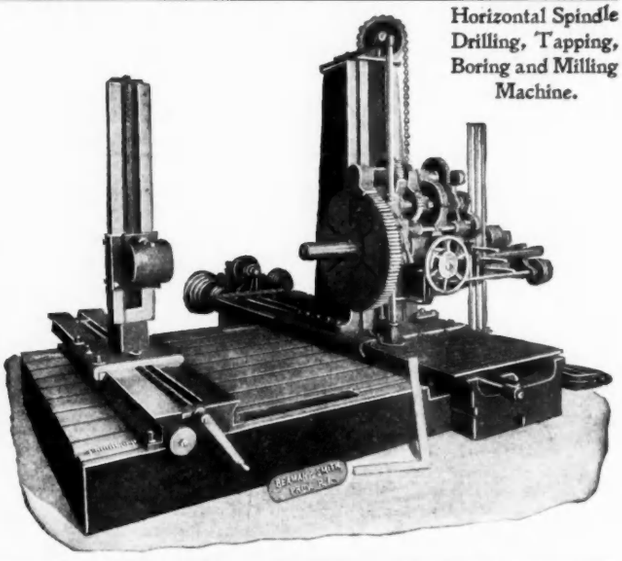

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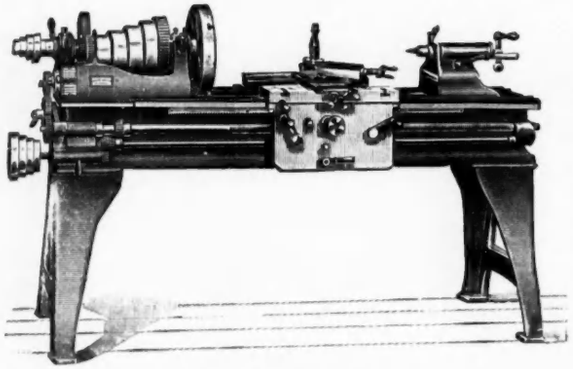

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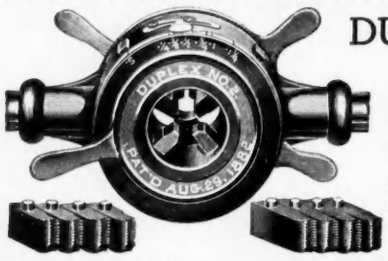

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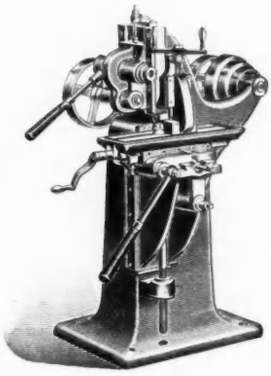

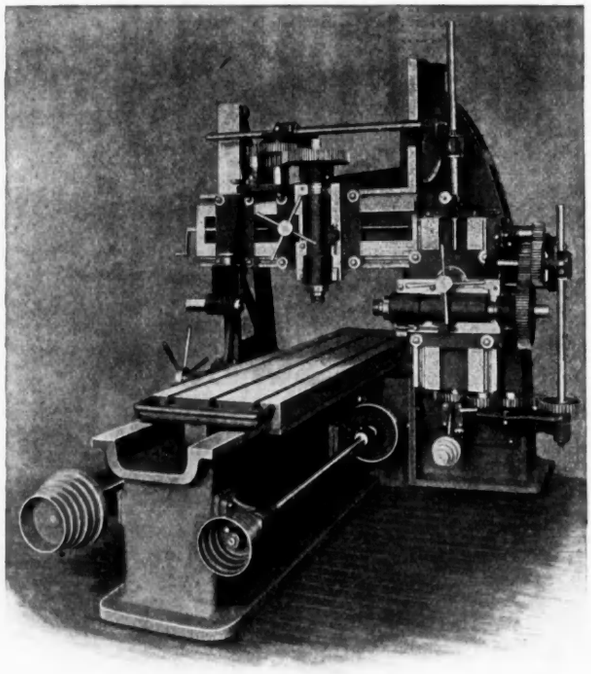

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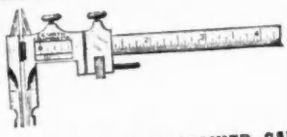

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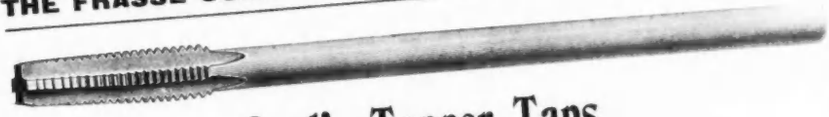

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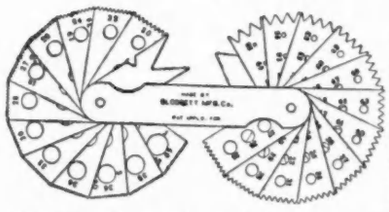

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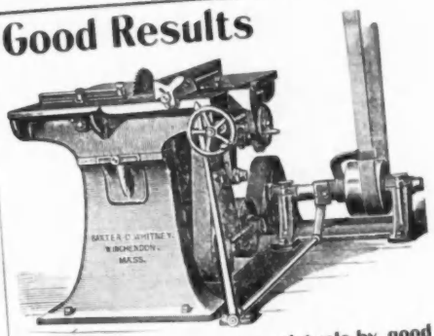

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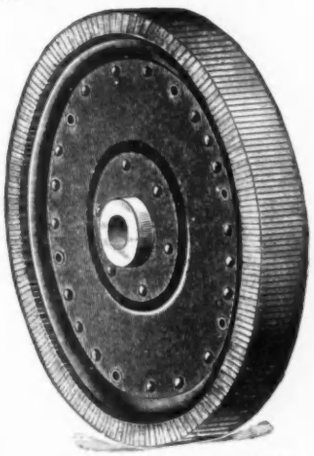

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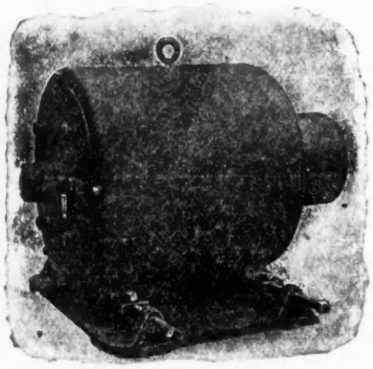

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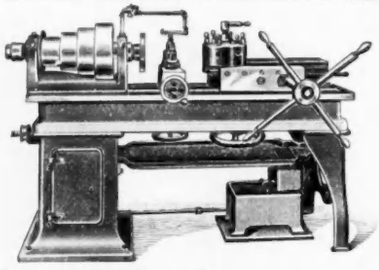

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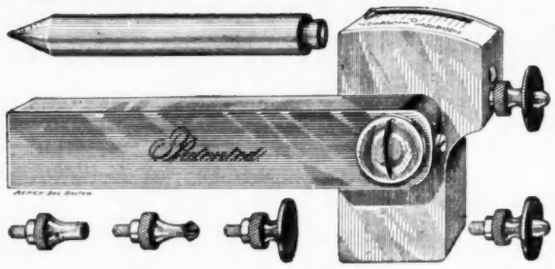

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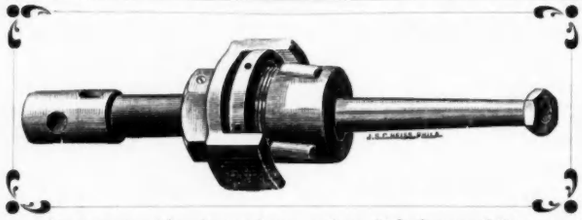

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No. 2 Cincinnati Universal, tool room, latest pattern, has vertical attachments.
No. 4 Garvin, plain back geared with centers.
No. 2 Garvin, plain without arm or back gears, all attachments.
No. 1 1-2 Garvin, plain without arm or back gears, all attachments.
No. 2 Newton, plain, B. G's, table 40 in. long.
No. 2 Brown & Sharpe, plain, B. G's, heavy pattern.
No. 2 J. L. Bogart, double column, plain, back gears.
Warner & Swasey, 4 spindle valve miller all attachments, nearly new.
36 in. Brainard, full Universal gear cutter, fine order.
25 in. Gould & Eberhardt, full aut. gear cutter.

SCREW MACHINES.

No. 3 Pratt & Whitney with W. F., aut. turret feed, all attachments.
No. 3 Pratt & Whitney, same attachments, except no automatic turret feed.
No. 2 1-2 Pratt & Whitney, fricton hd., drawing spindle.
No. 2 Pratt & Whitney, wire feed and all attachments.
No. 1 Windsor, with wire fd., a lot of chucks and tools.
No. 1 Jerome & Secor, with wire feed and all attachts.
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Heavy triple geared double column power press, weight 32 tons, bed 8 1-2 ft. long x 4 ft. wide, 3 in. stroke, very heavy.
No. 61 Bliss armature notching press, with dial feed and lot of dies.
5 Double housing power presses, 20 in. bet. housings, hole in bed 10 in. x 13 in., weight about 6,500 lbs., similar to No. 75 Stiles.
3 No. A3 Ardle power presses, hole in bed 5 x 5, weight 4,000 lbs.
No. 5 Eaton power press.
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1,000 lb. Bement steam hammer, nearly new.
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6 ft. Michel vertical boring and turning mill, 2 heads.
5 ft. Bement vertical boring and turning mill, 1 head.
42 in. Bullard vertical mill, has taper attachments and screw cutting device and chuck jaws.
37 in. Bullard mill, 2 heads, and chuck jaws, latest pat.
Style C Newark hor. bor. and drilling mach., 3 in. bar.
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70 in. x 16 ft. Whittier horizontal bor. mach., old style.

MISCELLANEOUS.

2 in. Sellers auto. bolt cutter, full set taps and dies.
1 1-2 in. National aut. bolt cutter, full set taps and dies.
1 1-4 in. Adams aut. bolt cutter, 4 sets of dies.
6 in. Bement slotter, all feeds.
One each, 49 and 33 in. Bullard armat. winding lathes.
10 in. Putnam slotter, all feeds.
2 Lee & Hunt cold sawing machines with eng. attached.
Pratt & Whitney metal band saw.
Also a lot of small tools, pulleys, shafting hangers and belting used in connection with above machinery.

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For Advertisement of
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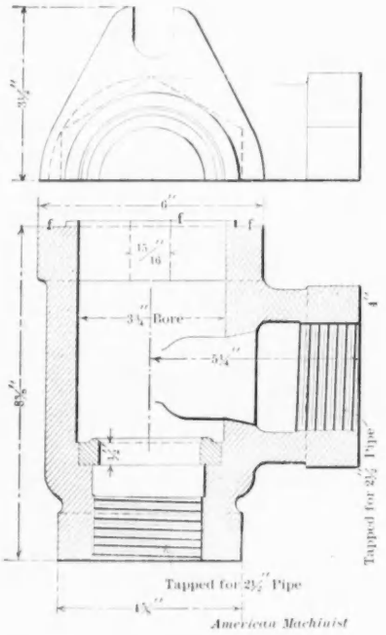

Bored, Faced, Tapped and Finished in 28 min.

Duplicate work of any character where boring, turning threading or facing is required is handled on a Gisholt Turret Lathe with rapid and economical results that are certainly most interesting.

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Fenwick Freres, 21 Rue Martel, Paris, France.
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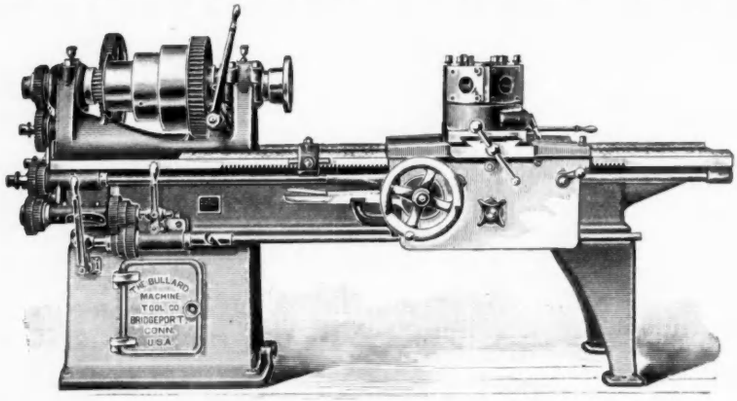

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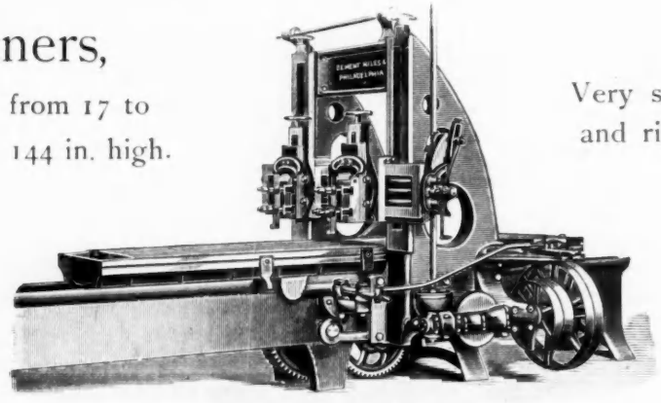

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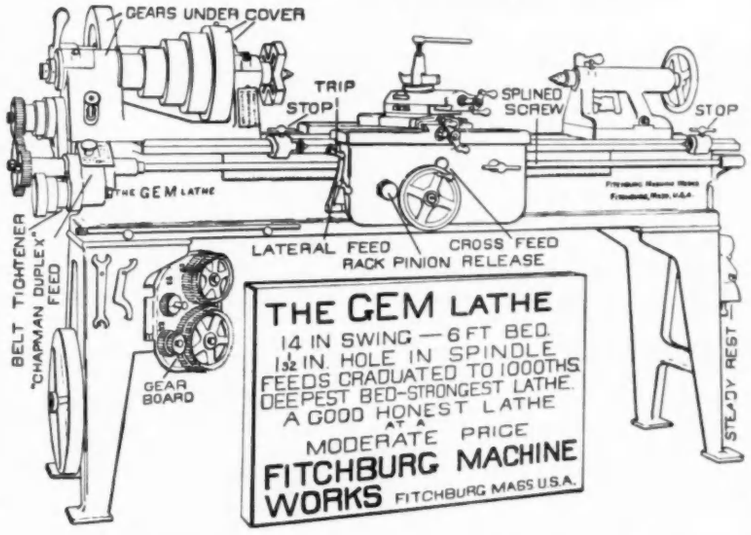

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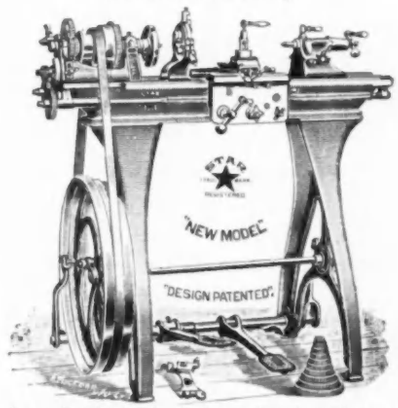

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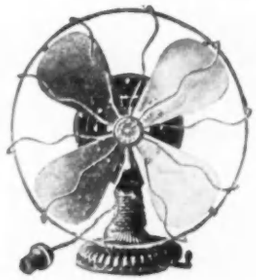

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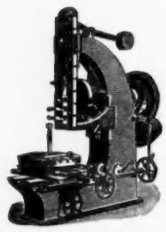

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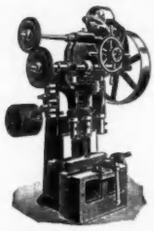

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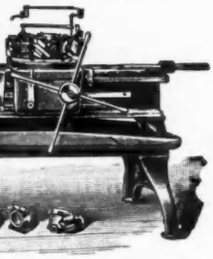

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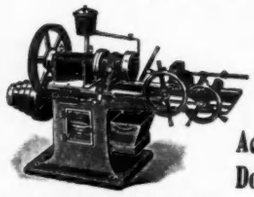

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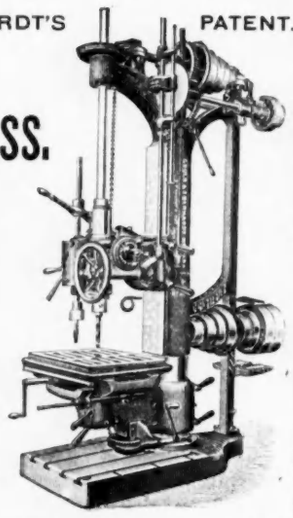

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